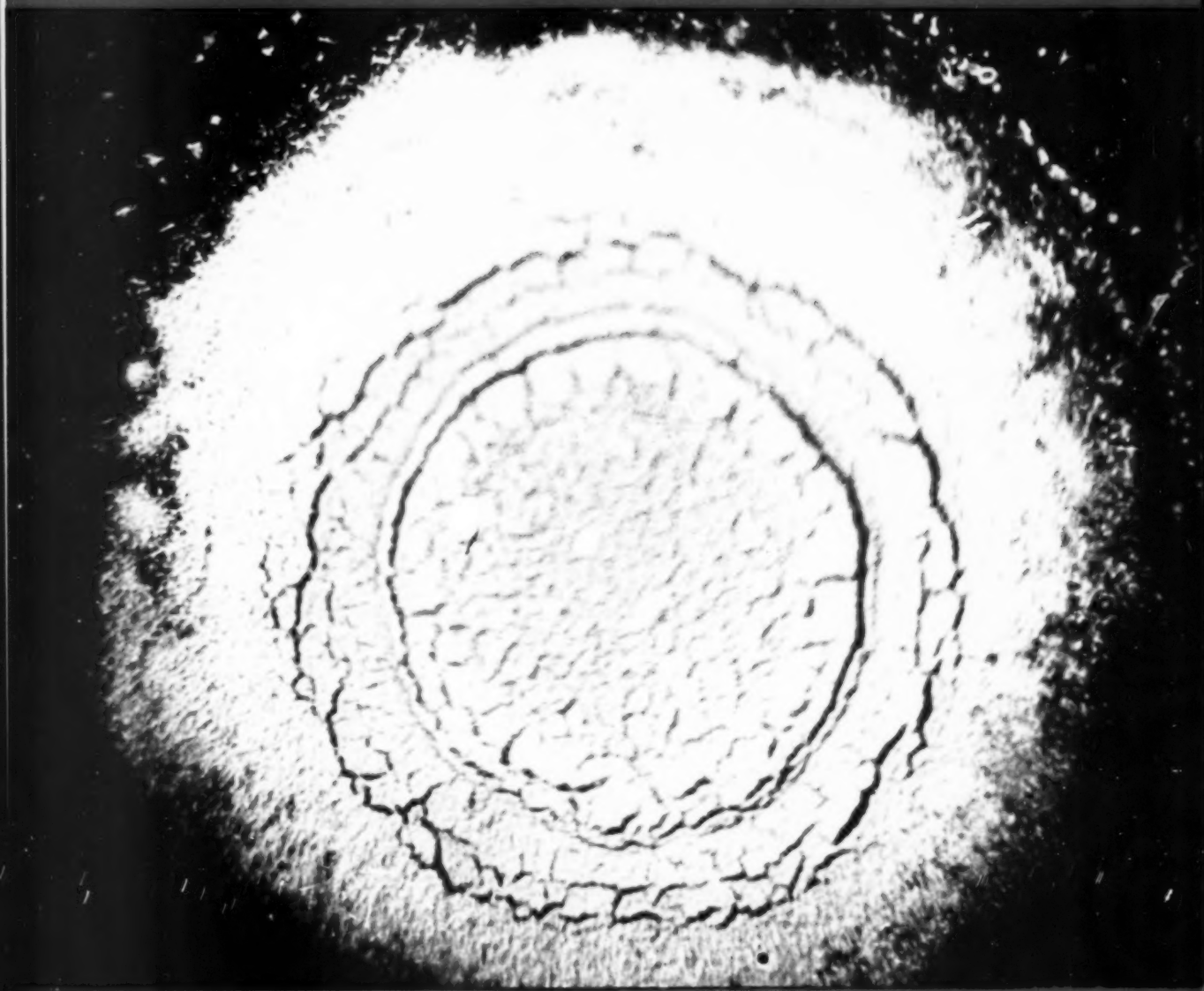
WATER & SEWAGE WORKS

WATER SUPPLY • INDUSTRIAL WASTE TREATMENT • SEWAGE DISPOSAL

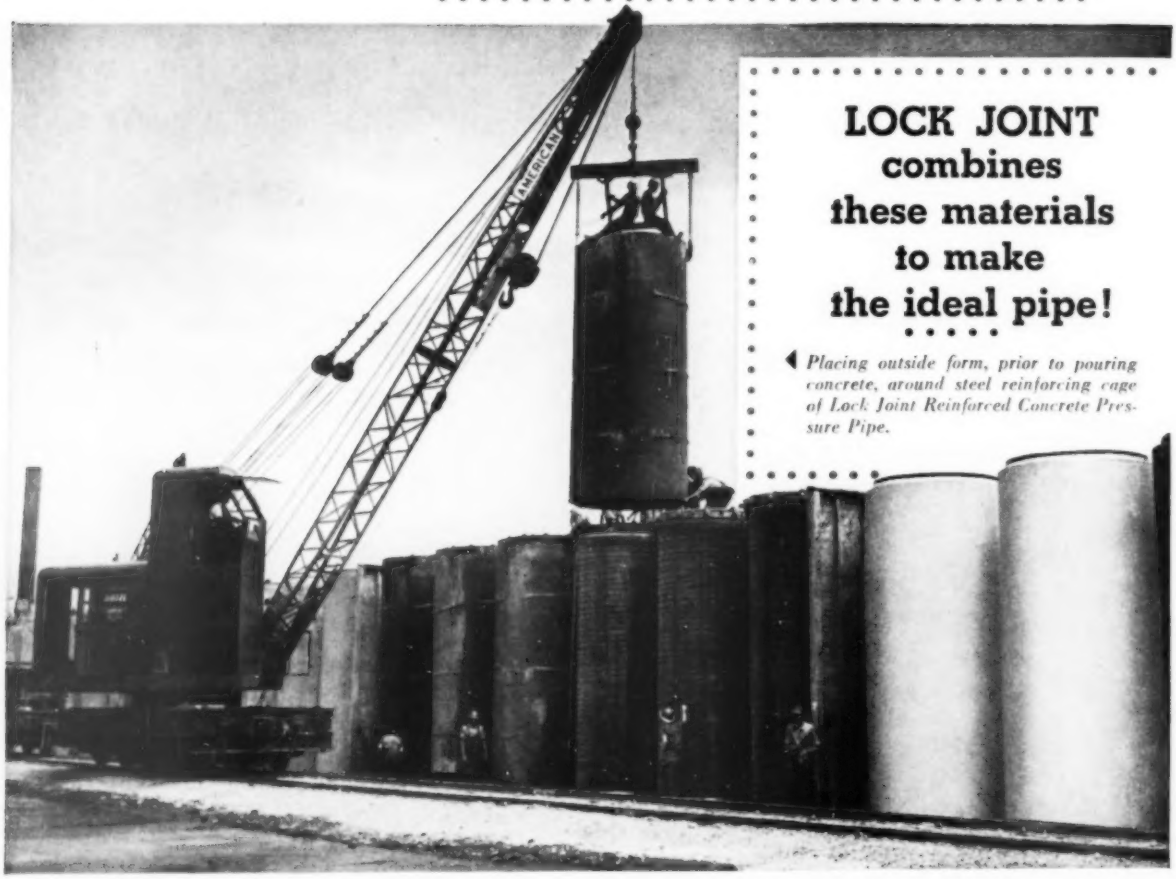


NOVEMBER, 1953

Not What it Looks Like . . . in Water it's Worse.

(See article p.p. 426-429 this issue.)

There's no substitute for CONCRETE and STEEL!



LOCK JOINT combines these materials to make the ideal pipe!

Placing outside form, prior to pouring concrete, around steel reinforcing cage of Lock Joint Reinforced Concrete Pressure Pipe.

CONCRETE, with its proven qualities of durability, non-corrosion, resistance to electrolytic action, and high compressive strength is combined, by Lock Joint, with steel's toughness, resilience and high tensile strength to make a pipe that retains the best qualities of both—non tuberculance, high structural strength and long life with little or no maintenance. Dense concrete affords complete protection for the quality reinforcing steel. Both materials are carefully calculated to meet your pressure needs with a wide factor of safety. The Lock Joint Pipe Company's Rubber and Steel Joint is extremely watertight and, at the same time, flexible.

For superior strength, carrying characteristics and trouble-free operation, let Lock Joint supply your pipe needs in sizes 16" and larger.

SCOPE OF SERVICES—*Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains 16" in diameter or larger, as well as Concrete Pipes of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.*

LOCK JOINT PIPE COMPANY

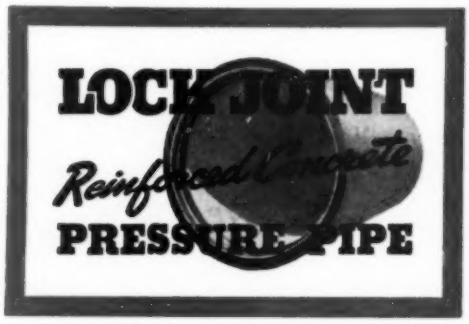
Established 1905

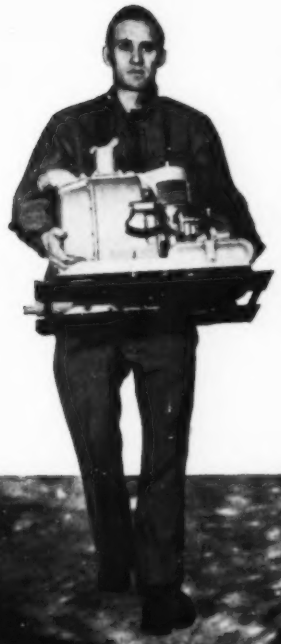
P. O. Box 269, East Orange, N. J.

PRESSURE PIPE PLANTS: Wharton, N. J., Turner, Kan., Detroit, Mich., Columbia, S. C.

SEWER & CULVERT PIPE PLANTS:

Casper, Wyo. • Cheyenne, Wyo. • Denver, Col. • Kansas City, Mo. • Kennett Square, Pa. • Valley Park, Mo. • Chicago, Ill. • Rock Island, Ill. • Wichita, Kan. Kenilworth, N. J. • Hartford, Conn. • Tucumcari, N. Mex. • Oklahoma City, Okla. Tulsa, Okla. • Beloit, Wis. • Hato Rey, P. R. • Ponce, P. R. • Caracas, Venezuela





AS EASY AS THIS...

One man picks up a Homelite and puts it right where you need pumping, *quickly*. No trucking problems, no planking, no hauling, no pushing.

AS FAST AS THIS...

With the fastest possible self-priming, a Homelite is instantly at work... pumping out water at a rate as high as 15,000 gallons an hour.

HOMELITE *Carryable* PUMPS

Where else can you find a pump so light, so easy to handle and so fast and dependable on the job. Light enough for one man to carry, a Homelite Gasoline Engine Driven Pump is big enough for any job. It primes fast. It pumps fast. It has a guaranteed 28 foot suction lift. And it keeps seepage automatically at strainer level...for better working conditions on the job.

Non-clogging, self scouring, quick starting, weather-proof and dust-proof, a Homelite is as dependable as the day is long. It's the rugged, trouble-free, fast-action pump you need for the stormy months ahead.

Write for a free on-your-job demonstration.

Manufacturers of Homelite
Carryable Pumps • Generators
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PERFORMANCE · DEPENDABILITY · SERVICE

HOMELITE
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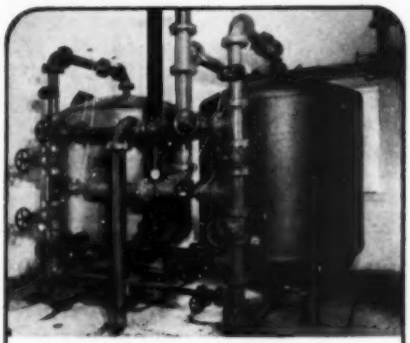
709 RIVERDALE AVENUE • PORT CHESTER, N. Y.

Canadian Distributors: Terry Machinery Co., Ltd., Toronto, Montreal, Vancouver, Quebec.

How Martinsville gets iron-free, soft water

Martinsville, Illinois Municipal Water Plant. Constructed in 1950.

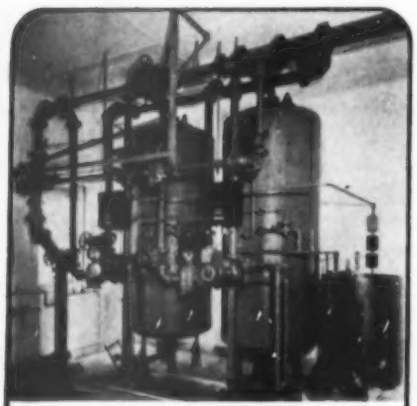


Compact Permutit pressure filters have a 150 gpm capacity...remove iron oxidized in coke-tray aerator, reduce turbidity.

MARTINSVILLE'S untreated well water was very hard . . . an extremely wasteful nuisance!

Its 269 ppm of total hardness ruinously scaled pipes and water heaters. And further annoyed citizens by wasting soap, leaving unsightly rings around bathtubs, sticky curd on dishes and laundry. Iron of 2 ppm—which gave the water an unpleasant metallic taste—caused objectionable stains on plumbing fixtures and laundered fabrics.

These troubles were ended when Martinsville installed the Permutit equipment shown. On a recent check, we asked for the operator's opinion of our equipment.



Permutit softeners remove hardness, further reduce iron to 0.02 ppm! Automatic regeneration saves time . . . provides constant supply of softened water.

Mr. O. Wiser—who is in charge of the Martinsville Municipal Water Plant—reports: "The Permutit equipment is very good . . . has worked very well with very little maintenance."

Free Technical Bulletins

Write today for full information on any water conditioning process or problem. THE PERMUTIT COMPANY, Dept. W-11, 330 West 42nd Street, New York 36, N. Y.

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WATER CONDITIONING HEADQUARTERS FOR OVER 40 YEARS

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WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL
INDUSTRIAL WASTE TREATMENT

COMING ARTICLES

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Developments in Sewage and Industrial Wastes—1953 ..... *Mohlman*
Taste and Odor Control Under Some Newer Concepts ..... *Silvey*
The New Softening and Iron Removal Plant of Dayton, Ohio ..... *Howson*
Cincinnati's Little Miami Sewage Treatment Plant ..... *Tolles*
The Purchase and Use of Lime—Some Basic Consideration ..... *Hoak*
Increasing Well Yields with Calgon Treatment ..... *Caplan*
Widening the Horizon for Chlorine Distribution in Ton Containers ..... *Wilharm*
The Selection, Operation and Maintenance of Valves ..... *Kaufmann*
The Calculation and Use of Water System Head Curves ..... *Mann*
Modified Rational Formula for Storm Run-off ..... *Ordon*
Sewage Works Practices (short-course type articles)* ..... *Bloodgood*

*In this issue one of a series of short-course articles on *Water Works Practices* by "Doc" Symons

"Sewage Works Practices," by Prof. Bloodgood of Purdue, comprises a companion series running in alternate issues.

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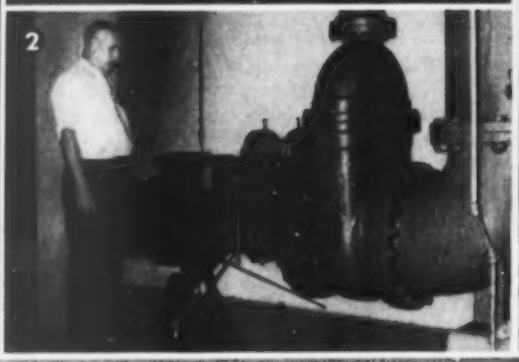
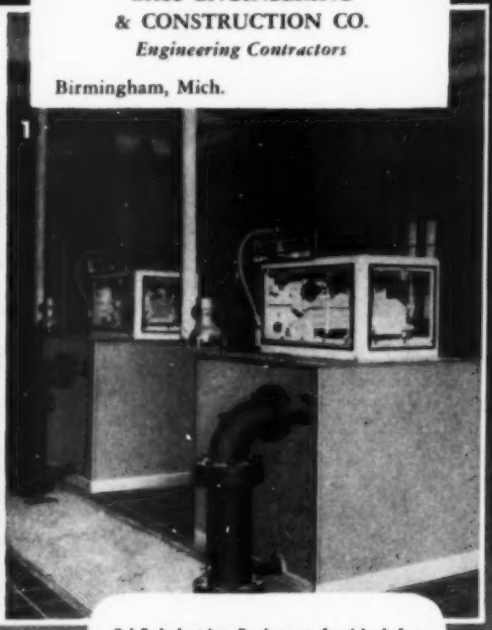
DAYTON, OHIO
Municipal Water Plant
(Completed in 1953)

ALVORD, BURDICK & HOWSON
Consulting Engineers
Chicago, Ill.

BASS ENGINEERING
& CONSTRUCTION CO.
Engineering Contractors
Birmingham, Mich.





Until May 27th, 1953 — dedication day for this new plant — the yellow stained dishes in the kitchen cupboards, the "tattle-tale" gray sheets in the linen closets, and the discolored plumbing fixtures in the homes of Dayton, Ohio were constant reminders of the sub-standard quality of Dayton's water supply. Popular demand is hard to see, but it's just as much a part of Dayton's new water softening and filtration plant as the Builders Gauges in the filter gallery and the Omega Chemical Feeders in the chemical building. Now, this modern plant assures Dayton of an adequate water supply of dependable quality and optimum hardness characteristics. This plant is under the direction of Loyd C. Huffman, Director of Water and Sewers.

CONTROL is built into every phase of the plant. Builders Water Works Controllers and Gauges maintain proper flow rates through the basins and filters. Omega Chemical Feeders and Lime Slakers likewise perform control functions, delivering chemicals at the exact rates demanded by the treatment load and the hardness of the water being treated. For information describing Builders and Omega Water Works Equipment, address B-I-F Industries, Providence, R. I.

B-I-F Industries Equipment furnished for the Dayton Municipal Water Plant:

OMEGA

2 — Model 44-20A Belt Gravimetric Feeders with Rotary Bin Gates and Lime Slakers — for quicklime.

2 — Model 44-20A Belt Gravimetric Feeders with Rotary Bin Gates — for alum.

2 — Model 50-B Belt Gravimetric Feeders with Rotary Bin Gates—for soda ash ❶

1 — Precision Solution Feeder — for polyphosphate

BUILDERS

Filter Controllers ❷ and Gauges

Chronoflo Transmitters and Receivers for metering flow and for pump control

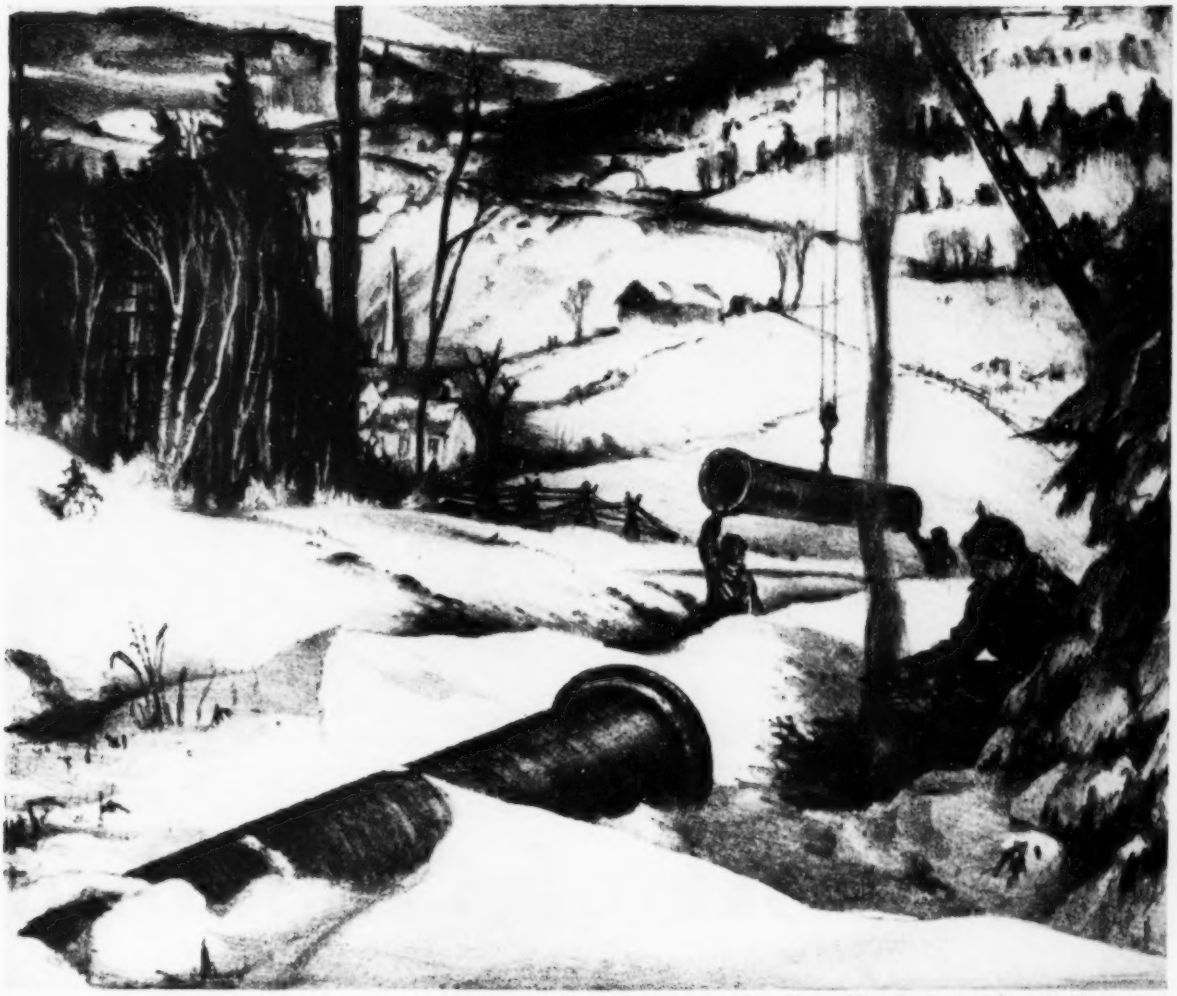
16" Model VTS4 Venturi Tube

BUILDERS

B-I-F INDUSTRIES

OMEGA

METERING • FEEDING • CONTROLLING EQUIPMENT



Lithographed on stone for U. S. Pipe and Foundry Co. by John A. Noble, A. N. A.

WINTER OR SUMMER, in the hills or on the flats, make no difference to cast iron pipe. Whether it is used for a water supply line, a gas feeder main or a pressure sewer, cast iron pipe has a rich history of highly satisfactory performance behind it for each type of service.

U. S. pipe centrifugally cast in metal molds up to 24-inch, pit cast pipe in the larger sizes and fittings are made in accordance with Federal, American Standard and American Water Works Association specifications wheresoever they apply.

With our production distributed in five strategically located plants, we are in an excellent position to meet your requirements.

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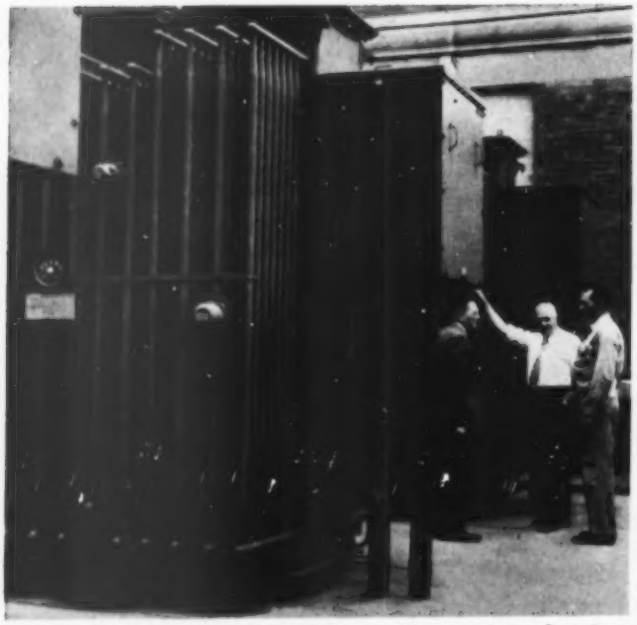
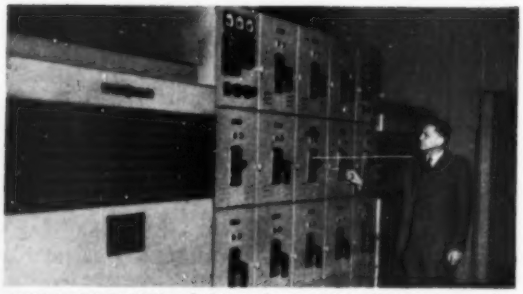
U.S.
cast iron
PIPE
FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE

INCREASED WATER-PUMPING CAPACITY was recently provided at this fifty-year-old Bryant St. pumping station in Washington, D.C., with the help of G-E equipment. Station receives water at low pressure and elevates it to four distribution services. Main centrifugal pumps at right act as boosters in this operation. Operators' control room is shown behind pumps.

District of Columbia

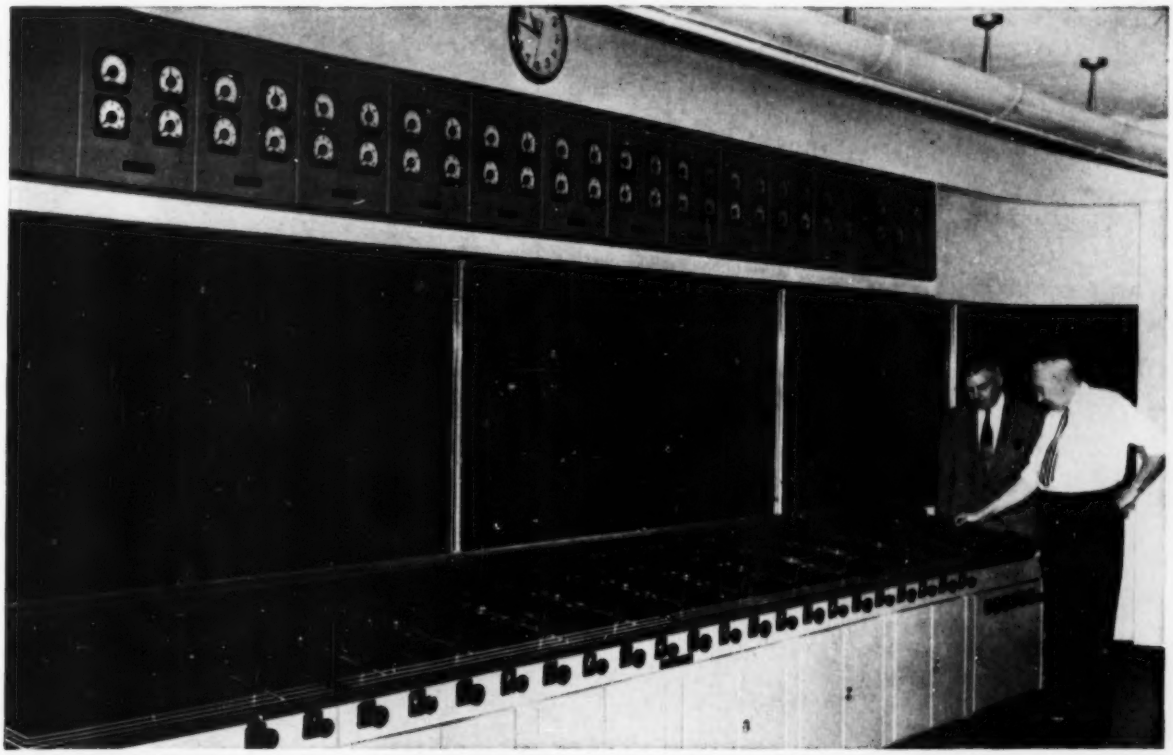


RELIABLE OUTDOOR UNIT SUBSTATION steps down voltage for plant use to 2400 volts. G-E application engineers on this job worked closely with the consulting engineers, and with the Central Armature Works, electrical contractors.



SIMPLE OPERATION of this indoor unit substation can be provided by one man. Shown here are two G-E transformers supplying power for switchboard.

COMPLETE PROTECTION and control for pump motors is provided by this 2400-volt G-E metal-clad switchgear. In addition, these compact units provide circuit protection.



CENTRALIZED CONTROL of all plant operations can be provided by one man from this master control desk. Versatile SB-1 switches on panel are used to control pump motors and valves. Easy-to-read switchboard instruments above window indicate station electrical values. The entire twenty-two foot long desk is housed in a single enclosure.

expands water system

New G-E equipment at Bryant St. Station helps to *more than double* pumping capacity

In order to handle rapidly growing water requirements in the District of Columbia, a new modernization and expansion program was recently placed in operation at the Bryant St. Station. As a result, the station's water-pumping capacity has been boosted from 145 mgd to 310 mgd, providing increased capacity for Washington's growing needs.

Instrumental in the success of this expansion program was General Electric equipment and engineering assistance. To help provide a co-ordinated electrical system designed for this particular installation at minimum cost, G-E application engineers worked in close co-operation with the city's consultants.

This same kind of help can pay off for *your* community's water supply program, too. G-E application engineers are ready to work closely with you and your consultants to fit the right electrical equipment into a system tailored to your particular needs. Call in your G-E apparatus sales engineer *early in your planning stages,* where he can help you the most.

SHOW YOUR COMMUNITY THE IMPORTANCE OF ABUNDANT WATER

Stimulate interest for a water supply program by showing the new color movie "Pipeline to the Clouds." It's part of G.E.'s *More Power to America* Water Supply Program. For full information contact your local G-E Apparatus Sales Office or write on your letterhead for Bulletin GEA-5555 to General Electric Co., Apparatus Sales Div., Sect., 666-80, Schenectady, N. Y.

Engineered Electrical Systems for Waterworks

GENERAL ELECTRIC

Cylinder valves are disassembled and completely overhauled at Pennsalt plants each time empty cylinders are returned for filling. Valves and cylinders are re-checked after cylinders are filled with *purified* Chlorine.

For trouble-free operation to avoid chlorinator shutdowns

USE PENNSALT CYLINDER CHLORINE

Here's why...

Purified Chlorine Pennsalt Chlorine is clean . . . contains no taffy to clog up chlorinators and cause costly repairs and downtime. Pennsalt is a dependable manufacturer specializing in the purification of Chlorine. Cylinders are filled only with water-works grade Chlorine.

Cylinder Valves In Excellent Working Order Valves open and close properly, easily, do not leak. Valves on Pennsalt Chlorine cylinders are disassembled, repacked, and thoroughly inspected *each* time empty cylinders are returned to a Pennsalt plant.

Pennsalt Is In The Cylinder Chlorine Business To Stay Cylinder Chlorine is an important part of our business. Our customers are satisfied and we intend to keep on satisfying them in the future. Shipments are prompt, and Pennsalt's trained technicians are available to assist you in any way. Avail yourself of this purified Chlorine and dependable service now. Contact the district office nearest you!

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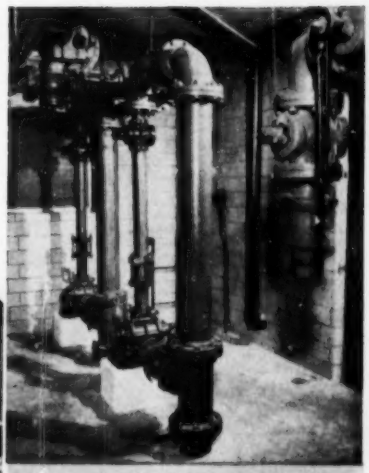
ANOTHER Sewage Treatment Plant



SEWAGE TREATMENT PLANT
Port Huron, Michigan
ENGINEERS
Drury McNamee & Porter Co.
Ann Arbor, Michigan
CONTRACTOR
Birmingham Construction Co.
Birmingham, Michigan

selects Byers Wrought Iron Pipe for "Hot Spot" Services

How to minimize future maintenance is the leading question of every thoughtful man concerned with sewage treatment plant construction. The leading answer is Byers Wrought Iron pipe.

Typical of this material's acceptance is the Port Huron, Michigan, Sewage Treatment Plant. Here, Byers Wrought Iron pipe was used to safeguard sludge heating lines, garbage grit lines, hot water heating system and hot water lines.

This confidence in genuine wrought iron pipe is almost universal in plants, large and small, in every part of the country. In Salina, Kansas, for example, the material was used in seven vital services—weir plates, scum baffle plates, scum troughs, distributor arms, all gas piping, vertical heat exchangers, and all hot water heating piping. And at Hyperion Sewage Treatment Plant, Los Angeles, Byers Wrought Iron was put to work in 51 services where corrosion was a threat to durability. Space limits a complete coverage, but these plants will serve to suggest the wide-spread use of genuine wrought iron by economy-minded engineers.

Call the roll of the most corrosive services in the modern treatment plant and you'll have a good check list of the places where Byers Wrought Iron pipe and plate is solving maintenance problems to the complete satisfaction of users.

If you would like to review the use that plants are making of this material, and to see some of the performance records that support the choice, write for our bulletin, WROUGHT IRON FOR SEWAGE TREATMENT AND DISPOSAL INSTALLATIONS. You'll find, too, the complete story behind the long established dependability of genuine wrought iron.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, N.Y.

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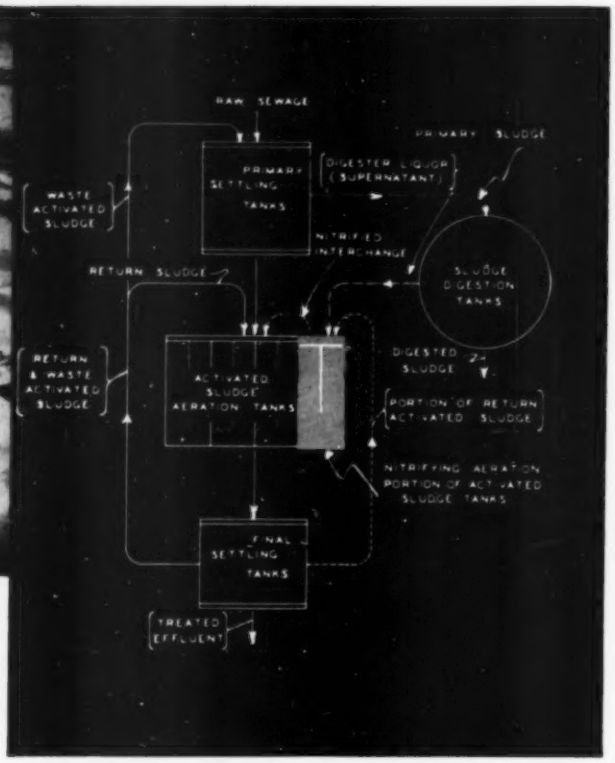
CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS



In St. Joseph—Benton Harbor, Mich....

this activated sludge plant to handle heavier seasonal loads with the "PFT KRAUS PROCESS"

In the design of the sewage treatment plant for the sister cities of St. Joseph and Benton Harbor for a population of 50,000 the engineers were confronted with a heavy load increase in summer—10,000 additional visitors, plus the equivalent of 25,000 in wastes from local canneries. *The problem was to handle an increased load of 70% during peak summer months.*

Solution—the "PFT Kraus Process", a new method of interchange to handle this heavier load *without* additional aeration basins, aeration facilities or appreciable greater amount of air. The increased load is handled by the "Kraus Process" method of piping and sludge pumping, and by making effective use of digestor liquor in the main treatment process.

How the process works—As shown in the diagram, a portion of the aeration tanks are set apart for nitrifying aeration. Digestor liquor or digested sludge, or a mixture of both, is then added to the nitrifying tank. The ammonia nitrogen in the digestor liquor or sludge is converted to nitrites or nitrates. This produces highly nitrified solids which are then returned to the remaining activated sludge aeration tanks. This process aids the entire waste treatment operation in two ways:

(1) During normal loads, it produces a sludge that settles more readily to provide greater purification.
(2) During peak loads, it provides a reserve of highly nitrified active solids which are readily available to balance the increased load of organic matter.

The highly nitrified sludge may be returned continuously to the normal activated sludge process or may be returned only when needed to overcome shock loads of organic matter.

Pacific Flush Tank has the exclusive rights for licensing this process and will supply immediate data and recommendations on request. Other plants now operating with the PFT Kraus Process include: Peoria, Ill., Rochelle, Ill., Durham, N.C., Woodstock, Ill.

Other PFT equipment installed in the new plant: 3 Floating Covers to fit 80′ Diameter Digestors; 2 Heater & Heat Exchanger Units (750,000 B.T.U./hr.); 3 Cover Position Indicators; Supernatant Selector and Gauge; 6 eight inch Rotary Sludge Withdrawal Valves; Gas Safety Equipment.

Design of plant by \ *Consoer, Townsend & Associates Chicago, Ill.*

P.F.T. **PACIFIC FLUSH TANK CO.**

Waste Treatment Equipment Exclusively Since 1893

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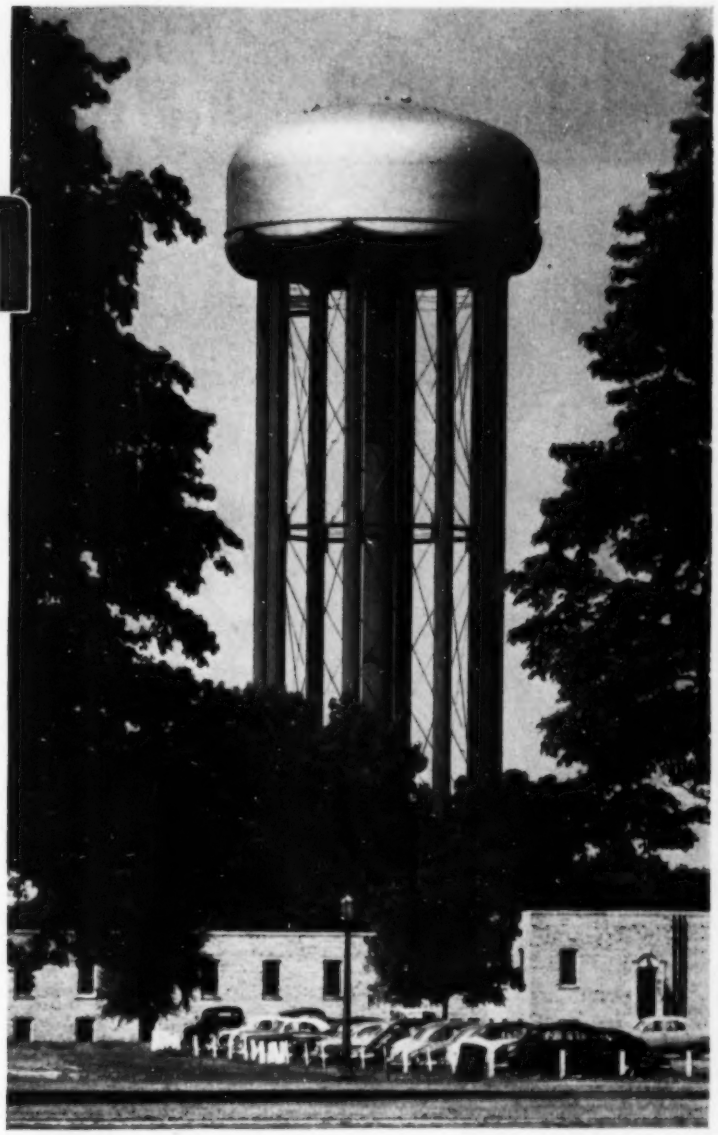
ELEVATED TANK

scores for Notre Dame



The University of Notre Dame formerly maintained two separate water distribution systems . . . one for drinking water and the other for general service. This arrangement posed a health threat because of the chance that untreated lake water might be used for drinking purposes.

By installing a 500,000-gal. Horton radial-cone bottom elevated tank and increasing the use of its wells, Notre Dame scored a victory over the hazard. A single system is now in use that provides simpler operation and positive sanitation.

Perhaps you have a problem similar to Notre Dame . . . one that an elevated tank can easily solve. Horton elevated tanks are built in standard capacities from 5,000 to 3,000,000 gallons. Write our nearest office for further information.

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CHICAGO BRIDGE & IRON COMPANY

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Houston 2	2115 C. & I. Life Bldg.	Tulsa 3	1646 Hunt Bldg.

No Need to Compromise on Water Quality

GIVE the best. And the simple, foolproof way to safeguard tap water against taste and odor pollution is the use of Aqua Nuchar Activated Carbon.

Let one of our Threshold Odor Experts show you how. Without obligation, he will make a thorough threshold odor survey of your plant. These surveys frequently point the way to reduction of over-all chemical costs as well as providing for complete taste and odor control through better utilization of Aqua Nuchar.

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PURE OIL BLDG.
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TYLOX

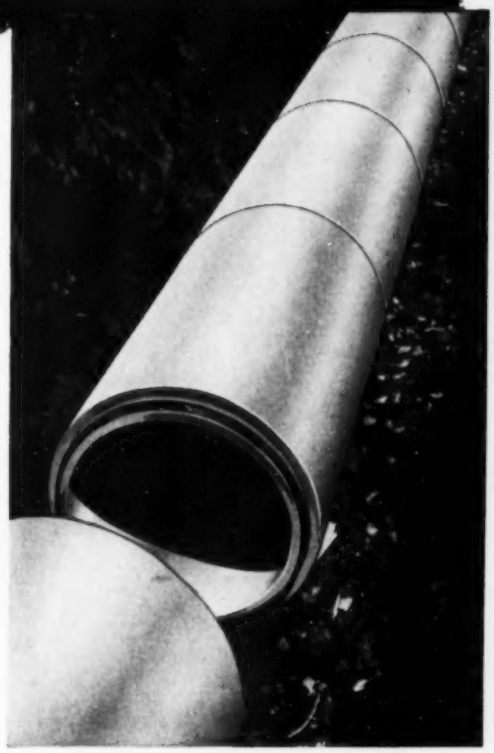
Flexible Rubber

IN PLANNING your disposal systems, specify Tylox Flexible Rubber Gaskets *now*, and be sure that sediment penetration through the pipe joints will not *later* cause flow restrictions that endanger public health, play havoc at treatment plants, and necessitate frequent and costly repairs.

Flexible Tylox Gaskets seal by *compression*, not—as in the case of mortared, precast or poured joints — by adhesion. Shoving the pipe home "packs" the Tylox Gasket tightly into the joint's annular space, and the natural resilience of the rubber *keeps* it tight . . . Tylox can't shrink away or crumble, to leave crevices in the joint for the entrance of sediment, ground water or roots.

And you can count on Tylox Jointing Gaskets to outlast the pipe itself . . . Tylox is made of a specially compounded rubber which resists sewage and industrial waste acids, and *stays* flexible. Regardless of the type of wastes to be handled by the line, or the type of soil in which it is laid, Tylox does not deteriorate. Its *mechanical* seal assures penetration-proof pipe joints for "the life of the line."

On your next tongue-and-groove, or bell-and-spigot pipe project, specify TYLOX RUBBER JOINTS. All down the line, from trench to treatment tank, TYLOX saves sewerage installation, maintenance and operating costs.

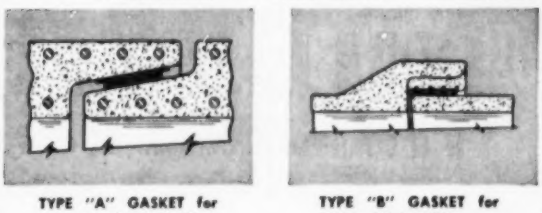


Making Joints with TYLOX RUBBER GASKETS is as simple as A B C

Lubricate sliding surfaces with TYLOX Cement.

Cement tongue and snap on TYLOX Gasket.

Shove the pipe home to line and grade.



TYPE "A" GASKET for Tongue-and-Groove Pipe.

TYPE "B" GASKET for Bell-and-Spigot Pipe.

1846

HAMILTON KENT
MANUFACTURING COMPANY
KENT, OHIO
225 Gougler Ave. Tel. 3449

for dependable performance... low maintenance...

Jeffrey BACK-CLEANED Screens

The treatment of water, sewage and industrial waste by mechanical means has definitely proved to be most effective and economical. It is now the accepted standard for new plants, including those for small villages.

Based on new design principles, these Jeffrey mechanically-cleaned bar screens are practically foolproof.

Jeffrey bar screens are furnished coarse or fine (as shown) with round or rectangular bars, in widths and lengths to meet job requirements. Write for Catalog 833 on Jeffrey equipment for industrial waste, water and sewage treatment.

Other Jeffrey sanitation equipment includes:

Screening Grinders
Grit Collectors and Washers
Sludge Collectors for Primary and Final Settling Tanks
FLOCTROLS (Controlled Flocculation)
Belt and Spiral Conveyors
Chains and Sprockets
Scum Removers
Dry Feed Chemical Machines
Biofiltration Plant Equipment
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THE JEFFREY MANUFACTURING CO.

ESTABLISHED 1877

Columbus 16, Ohio

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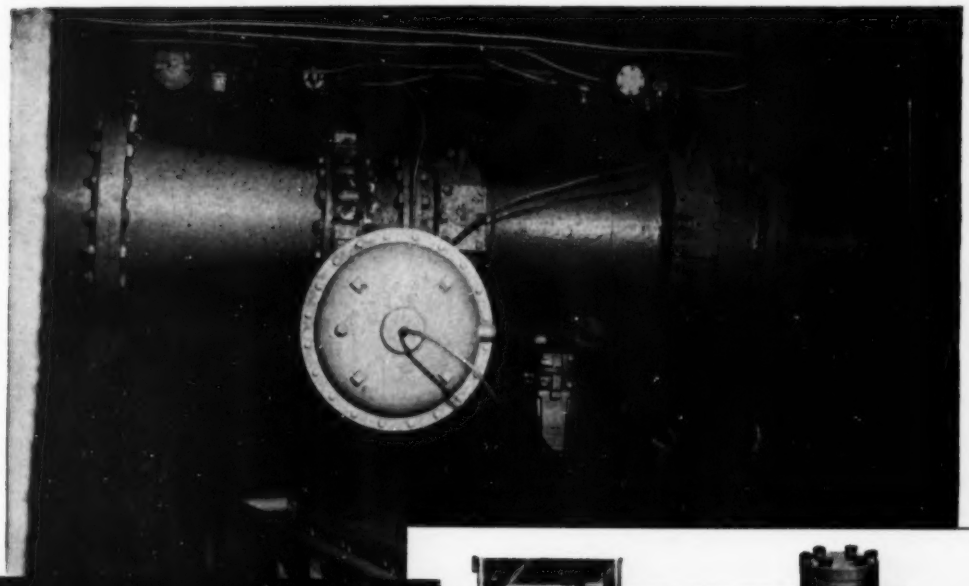
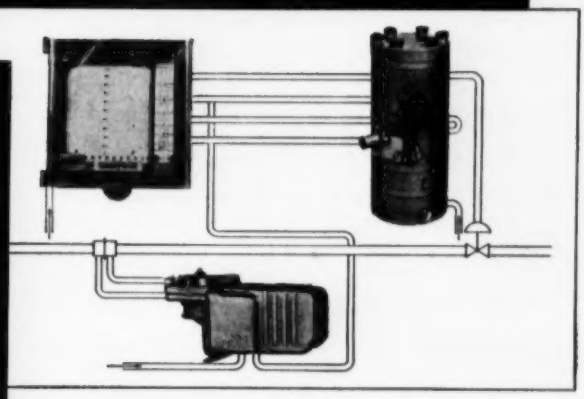
PLANTS IN CANADA, ENGLAND, SOUTH AFRICA

IF IT'S MINED, PROCESSED OR MOVED ...IT'S A JOB FOR JEFFREY!



engineered instrumentation *helps fight stream pollution*



COMPACT CONTROL SYSTEM, *using Tel-O-Set Controller and Differential Converter, fits readily in the sump of an industrial waste-treatment plant . . . controls flow right on the spot. Inset shows simple basic elements of typical Tel-O-Set flow control system.*

By utilizing the *Tel-O-Set* family of miniature indicators, recorders and controllers, your waste treatment processes can reap the benefits of precise, dependable control . . . through instrumentation so compact that it goes wherever you need it.

They're versatile: supplied for measuring and controlling flow, temperature, pressure and liquid level . . . with a broad selection of primary elements and remote pneumatic transmitting devices.

They're accurate: transmitter and controller can be readily located at the point of measurement to eliminate time lags.

They're compact: *Tel-O-Set* indicators and recorders fit readily into graphic panels . . . need only 5″ by 5″ panel area. Differential Converter and *Tel-O-Set* Controller need extremely little elbow room . . . fit easily into cramped quarters in sumps and wells.

They're economical: initial cost is reasonable, and maintenance requirements are practically negligible.

Water and sewage plant superintendents in increasing numbers are finding that *Tel-O-Set* instruments measure up to the highest standards of dependability and performance. Your local Honeywell engineering representative will be glad to discuss your own plant's control needs with you and your consulting engineer. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4575 Wayne Ave., Phila. 44, Pa.

REFERENCE DATA: Write for Data Sheets and Bulletins on *Tel-O-Set* instruments.

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

Research and Development bring you this finer-than-ever pipe

You can't better a product like cast iron pressure pipe—with its unparalleled record of long life, economy and efficiency—by waving a wand. Yet the story of how the best product in its field has been made *still better* can be told in a paragraph.

***Modernized* cast iron pipe is a result of the sum total of recent product and process improvements attained by research and development.**

It is centrifugally-cast and, when needed, centrifugally cement-lined. It is tougher, stronger, more uniform in quality. It is tuberculation-proof with sustained carrying capacity for the life of the pipe.

If you want the most efficient and economical pipe ever made for water distribution, your new mains will be laid with *modernized* cast iron pipe with either mechanical or bell-and-spigot joints. Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Ave., Chicago 3.

This cast iron water main, uncovered for inspection, is in good condition after over a century of service in Detroit, Mich. —one of more than 45 cities with century-old water or gas mains in service.

Modernized **cast iron**

CAST Q IRON

The Q-Check stencilled on pipe is the Registered Service Mark of the Cast Iron Pipe Research Association.

pipe *for Modern Waterworks Operation*

MODERN, NUISANCE-FREE

Refuse Disposal

to highest community standards

GREEN BAY, WISCONSIN
Capacity 120 tons per 24 hours

PITTSBURGH • DES MOINES

High Temperature

REFUSE INCINERATORS

WILMINGTON, DELAWARE
Capacity 225 tons per 24 hours

MONROE, WISCONSIN
Capacity 30 tons per 24 hours

BURLINGTON, NORTH CAROLINA
Capacity 60 tons per 24 hours

The problems of refuse disposal at low cost and without offense to surrounding areas are answered effectively by Pittsburgh-Des Moines Incinerators. Operating at high temperatures, these efficient units burn combustible refuse completely, without odor or objectionable smoke, and are built in all capacities. Let us consult on your particular requirements, without obligation.

PITTSBURGH • DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

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LOS ANGELES (48), ... 6399 Wilshire Blvd.
DES MOINES (8), 919 Tuttle Street
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SANTA CLARA, CAL., 625 Alviso Road

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HERSEY COMPOUND METER

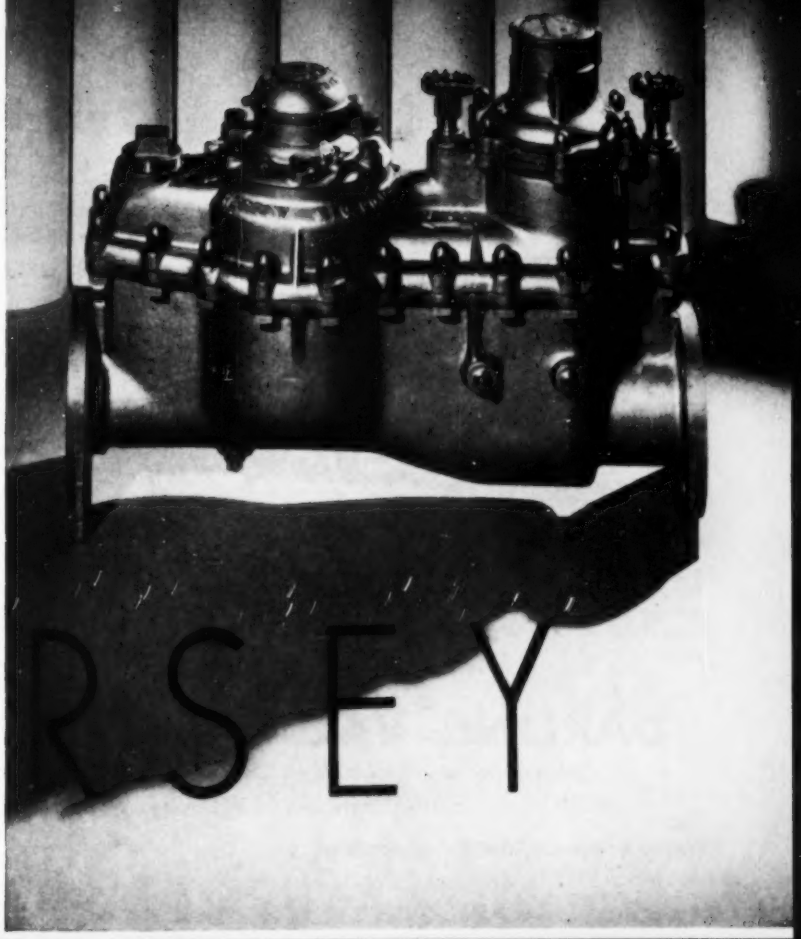
Water Works Engineers who have made very careful tests always arrive at the same results; namely, that HERSEY Compound Meters have never been equaled for accurate registration of all rates of flow.

Self-contained Bronze Case up to 6"

HERSEY MANUFACTURING COMPANY

SOUTH BOSTON, MASS.

BRANCH OFFICES: NEW YORK — PORTLAND, ORE. — PHILADELPHIA — ATLANTA — DALLAS — CHICAGO — SAN FRANCISCO — LOS ANGELES



Smoothest operating and best by far

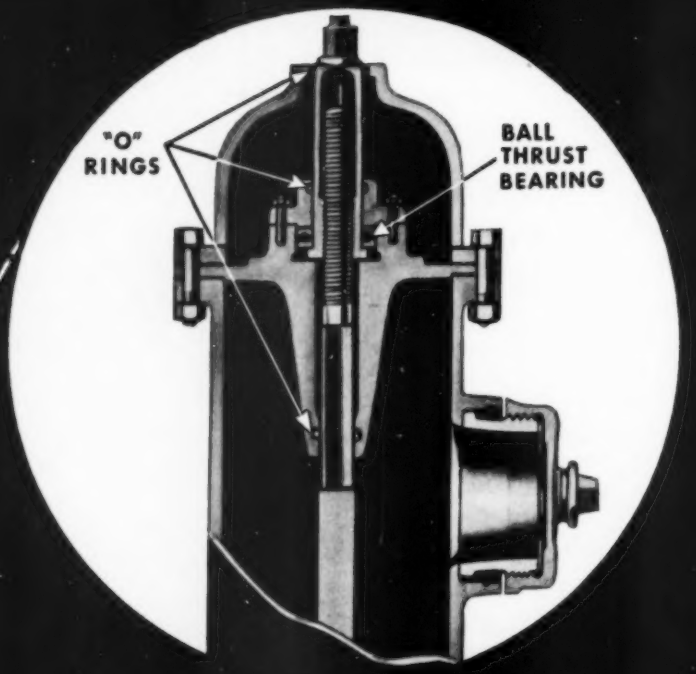


Photo above shows modern, clean-cut design of new Darling B-50-B fire hydrant. As in any Darling hydrant all *inside working parts, including main valve and drain valve parts, can be removed through the top for easy inspection and simplified maintenance.*

DARLING
B-50-B FIRE HYDRANT

THE Darling B-50-B fire hydrant, rated a major advance in hydrant design, eliminates the very things that often lead to unexpected trouble and failure in hydrant operation.

Note that it is *ball bearing* operated, for the smoothest, *surest* action ever! Opening and closing actually takes less than half the usual wrench torque!

Note, also, how the B-50-B design uses "O" ring seals, dispensing with the usual stuffing box, and resulting in a *dry top* hydrant! Moreover, these "O" ring seals not only prevent the loss of thread and bearing lubricant, but never let a drop of water reach the operating threads.

In short, the revolutionary B-50-B not only does away with much bothersome servicing such as gland adjustment, lubrication and packing replacement, but assures fast, easy operation when you need it most!

Before you decide on *any* hydrant, be sure to weigh *all* the advantages of Darling's B-50-B hydrant.

Send for Bulletin No. 5007

DARLING VALVE & MANUFACTURING CO.

"Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ontario"

Williamsport 11, Pa.

FIRST
in 1000 years

NEVER BEFORE, not even a few short years ago, could the new Fischer & Porter Ratochlor* chlorinator be built!

Why?

Like the jet engine, which could not be born until all the complex alloys and ceramics necessary to resist its great heat were available — like controlled atomic fission, which required complex mathematics and multi-complex mechanics — so the new **F & P** Ratochlor unit needed many new and complex developments of the laboratory before it could be produced for thoroughly dependable use.

With a cabinet completely formed from polymer-impregnated fiber glass, with Uscolite tubing and fittings, with Kel-F, Teflon, tantalum, and silver components, the 1050 series unit is practically impervious to chlorine corrosion.

Offering complete simplicity of operation and freedom from maintenance problems, the new **F & P** chlorinator automatically assures maximum water economy over an extra wide flow range.

These are only a few of the many reasons why this new unit is important to every industrial and municipal user of chlorine. It is the result of years of concentration by **F & P** on the problems inherent in chlorination. Write today for complete descriptive literature which tells the whole story from idea to reality.

Ratochlor units in F & P Hatboro plant awaiting inspection and test *with chlorine* under actual operating conditions.

*T. M., F&P Co.

complete process instrumentation

FISCHER & PORTER CO.

3010 County Line Road, Hatboro, Penn.

2260

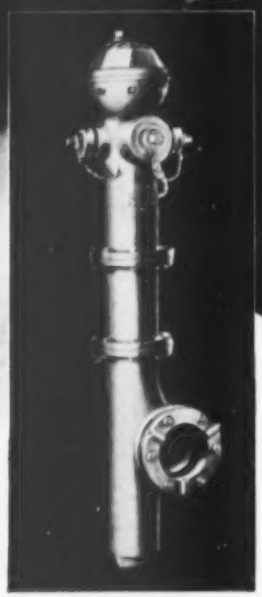
Company owned sales and service branches strategically located throughout the world.

"We'll save time and money, Bob,

by installing IOWA MECHANICAL JOINT hydrants and gate valves—they fit any class of cast-iron pipe!"

Cost-conscious water works men the nation over are switching to Iowa mechanical joint hydrants and gate valves for *three* cost-cutting reasons: (1) They will fit the cast-iron pipe in your water distribution system, no matter how old—speed installation—save time. (2) Shipped complete with all joint accessories. No lead, jute or calking is required—only a ratchet wrench needed. Can be installed even in a wet trench. (3) They offer quick replacement of old-style, obsolete, worn-out hydrants and valves—reduce maintenance expense.

Iowa Products will meet your most exacting specifications, and meet them at lowest cost. Write today for full details and actual case histories.



Iowa Mechanical Joint Hydrants

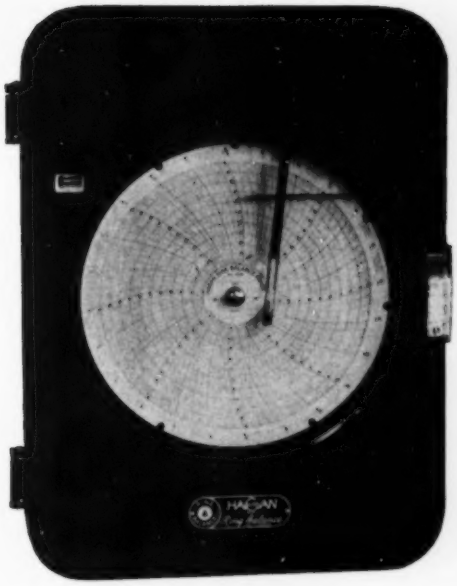
Two-piece operating nut with special adjustment screw solves the problems of expansion and contraction—makes Iowa hydrants easy to operate at all times. Positive operating mechanical drain valve can be removed along with all other working parts through top of hydrant without special tools. Fixed position of valve arms makes leaking impossible should standpipe be broken. Unrestricted water flow gives full pressure at extreme low loss of head. Built to conform to the latest A.W.W.A. specifications.

Iowa Mechanical Joint Gate Valves

Bronze mounted—simple, rugged construction. Parallel seat, double disc type with independent solid bronze wedges and stem nut. Every joint makes up bottle-tight. Built to conform to the latest A.W.W.A. specifications.

"It's wise to modernize with Iowa mechanical joint hydrants and gate valves."

IOWA VALVE COMPANY
A Subsidiary of James B. Clow & Sons
201-299 NORTH TALMAN AVENUE
CHICAGO 80, ILLINOIS



When you install

HAGAN RING BALANCE FLOW METERS

You install

Accuracy

Dependability

Durability

Versatility

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
CONTROL SYSTEMS FOR AUTOMOTIVE AND
AERONAUTICAL TESTING LABORATORIES

Hagan Ring Balance Flow Meters give dependable readings over the chart range, and give good response at low flow rates.

The calibration may be checked under full static pressure conditions by a simple check-weight method. One man can check calibration in a few minutes.

The simplicity of design, coupled with sturdy construction, assure long meter life and low maintenance costs.

The Hagan Ring Balance Meter is the most versatile meter made. Whatever your metering problems, our engineers will be glad to show you how Hagan Meters can help you solve them.

HAGAN CORPORATION

HAGAN BUILDING • PITTSBURGH 30, PA.

Hagan Corporation
Hagan Building
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Please send me further information on Hagan Ring Balance Meters.

I am particularly interested in _____

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COMPANY _____

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CITY _____ ZONE ____ STATE _____

SPECIFY RODNEY HUNT

FOR SLUICE GATES

Standard Sizes: 6" to 108" diameter
Larger Rectangular Sizes
for Special Installations

Illustrated is a 54" x 54" cast iron bronze-mounted sluice gate with the stem encased in an oil cylinder to prevent freezing. This special non-freezing stem and the selective two speed floor-stand—equipped with Timken tapered roller bearings—are part of the *standard* Rodney Hunt line—one of 2000 sluice gate combinations that can be ordered directly from the Rodney Hunt catalog!

Rodney Hunt sluice gates are characterized by easy installation, a high degree of water-tightness and complete dependability. These gates are the finest quality obtainable! Yet because of new manufacturing equipment and modern foundry practice, they are competitively priced . . . and delivered to meet your construction schedule!

Free! 232-page color catalog

This is one of the most complete works in the field. It contains photographs, drawings, specifications and complete descriptions of our sluice gates, timber gates, hoists, valves, racks and rakes, plus a valuable 28-page section of engineering data on hydraulic problems.

This important catalog was specially prepared and edited for consulting engineers, contractors and other executives who are *actively* engaged in the water control field. Please write on your letterhead for Catalog WCA-952. Rodney Hunt Machine Co., 84 Lake St., Orange, Mass., U.S.A.

RODNEY HUNT

Water Control Apparatus Division

Manufacturing Engineers Since 1840

The Symbol for Service, Quality and Performance in Water Meters

The Extra Value of STAINLESS STEEL TRIM in all Rockwell Disc Meters

TROPIC TYPE
All-bronze, split case construction

ARCTIC TYPE
A bronze meter with breakable frost bottom

ALL THESE VITAL PARTS NOW STAINLESS STEEL

DISC SPINDLE . . .

DIAL FACE ON STRAIGHT READING REGISTER . . . . .

GEAR TRAIN SCREWS

DIVISION PLATE . . . .

STUFFING BOX SPINDLE .

DRIVING DOG . . . .

You can't beat stainless steel for corrosion resistance and durability. That's why you find stainless used in Rockwell Disc meters wherever these superior qualities are required. It's just another indication of the high standards that Rockwell engineers into meters—another reason why Rockwell meters last longer and are so economical to repair.

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NEW Transite® provides

2.
2.
1.
3.
This cut-away* section shows:
1. Pipe ends automatically separated for flexibility and expansion.
2. Rubber rings compressed for water-tightness.
3. Coupling and pipe made of long-lived corrosion-resistant asbestos-cement Transite.

INSTALLATION OF TRANSITE RING-TITE COUPLING IS SURE, SIMPLE, EASY

A. Rubber rings in groove before assembly

B. Rubber rings compressed after assembly

* **NOTE:** In the large photograph above, a portion of the Ring-Tite Coupling has been removed to show its design. One rubber ring has been cut to illustrate how it is compressed between pipe and coupling.

Johns-Manville

RING-TITE® Coupling

greater economy in pipeline installation ... maximum performance in service

- **Simplifies Transite Pressure Pipe assembly**
- **Reduces installation time**
- **Helps assure tight, flexible joints**

Here on this 12" New England installation of the Ring-Tite Coupling, the contractor's bid was based on installing 400 feet per working day for the job conditions prevailing. Actual laying time averaged over 700 feet per day!

Actual experience on this New Jersey installation by a prominent water works utility established entirely new concepts of installation savings effected by the Ring-Tite Coupling. On the job shown, 600 feet of pipe were laid in 5 hours.

Because of its unique design, the new Johns-Manville Ring-Tite Coupling provides many money-saving advantages. For example, no complicated equipment is required for line assembly. With tight, flexible Ring-Tite joints easily obtained, the contractor can get in and get out quickly with a substantial saving of time and money.

Ring-Tite Coupling installations can be made under adverse weather, temperature, or terrain conditions. Loose sand, slippery clay, mud and ice do not interrupt pipe assembly nor affect the performance of the completed assembly. Transite Pressure Pipe and Ring-Tite Couplings can be assembled in wet trenches.

Rings automatically positioned and locked in place

Pipes need only rough aligning. The coupling does the rest automatically . . . centers, aligns and adjusts for expansion. Rings are automatically pre-positioned by simply "popping" them into prepared grooves . . . and when the pipe is being pulled, the sliding motion of the rings squeegees all loose foreign material from the end of the pipe.

Each Ring-Tite Coupling is automatically stopped in exactly the correct sealing position to assure maximum water tightness and joint flexibility . . . to permit conformance to curves . . . to withstand shock and vibration . . . to relieve line stresses.

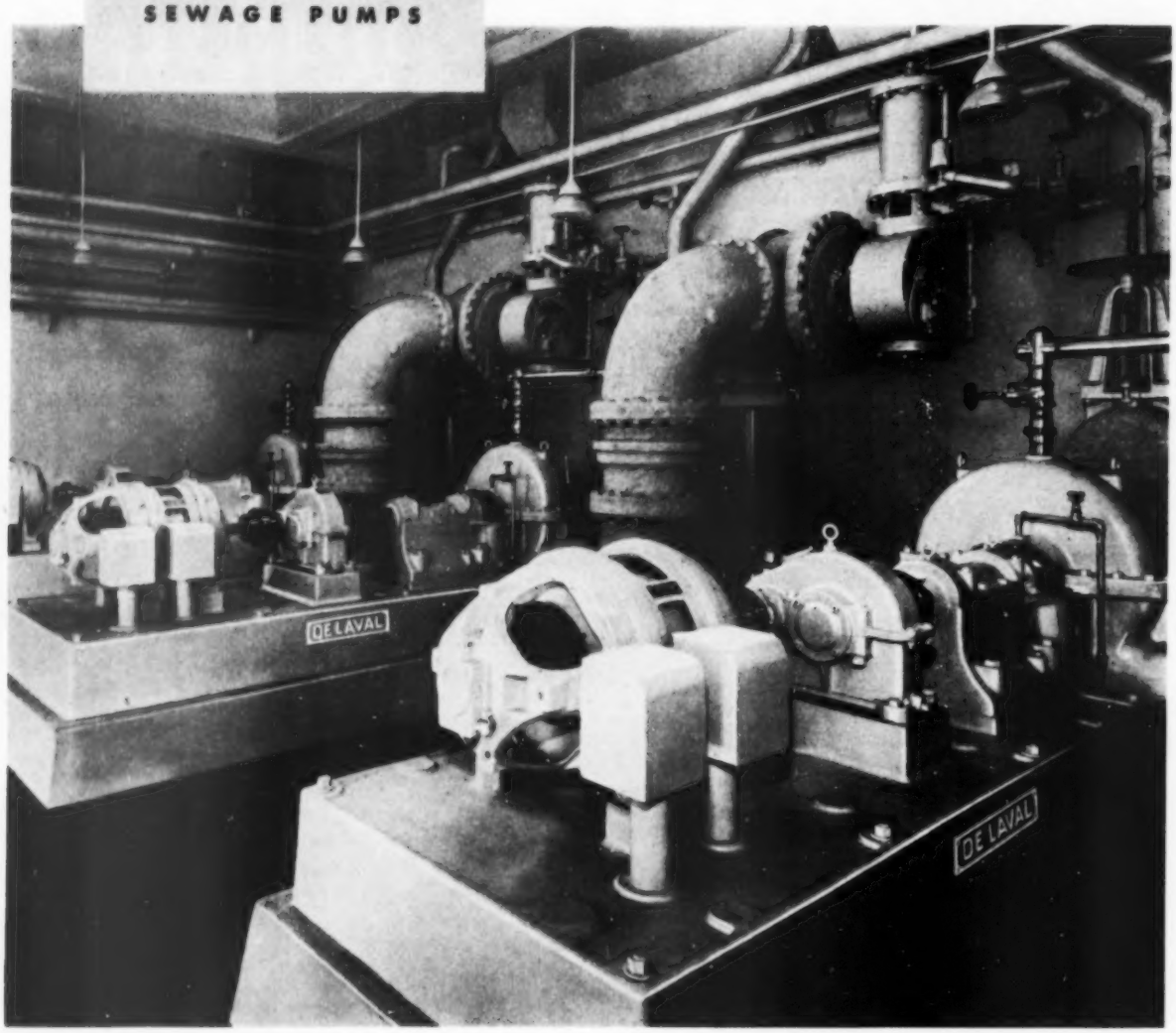
As a long-term investment, Transite Pressure Pipe effects outstanding performance and economies in your water supply and distribution expansion programs. Now the Ring-Tite Coupling brings you equally substantial *installation* economies—*immediate* savings!

For further information, write Johns-Manville, Box 60, New York 16, N. Y.

TRANSITE PRESSURE PIPE

JOHNS MANVILLE JM PRODUCTS

DE LAVAL SEWAGE PUMPS *serve Baltimore's new plant*



Three De Laval sewage pumps are on the job in the City of Baltimore's new Brooklyn Sewage Pumping Station built for today's need and planned for future expansion.

Two of these high efficiency motor-driven horizontal pumps have a capacity of 3,000 gpm and the third has a capacity of 7,000 gpm. Later, as flow increases, the two 3,000 gpm units can be replaced by a 7,000 gpm pump.

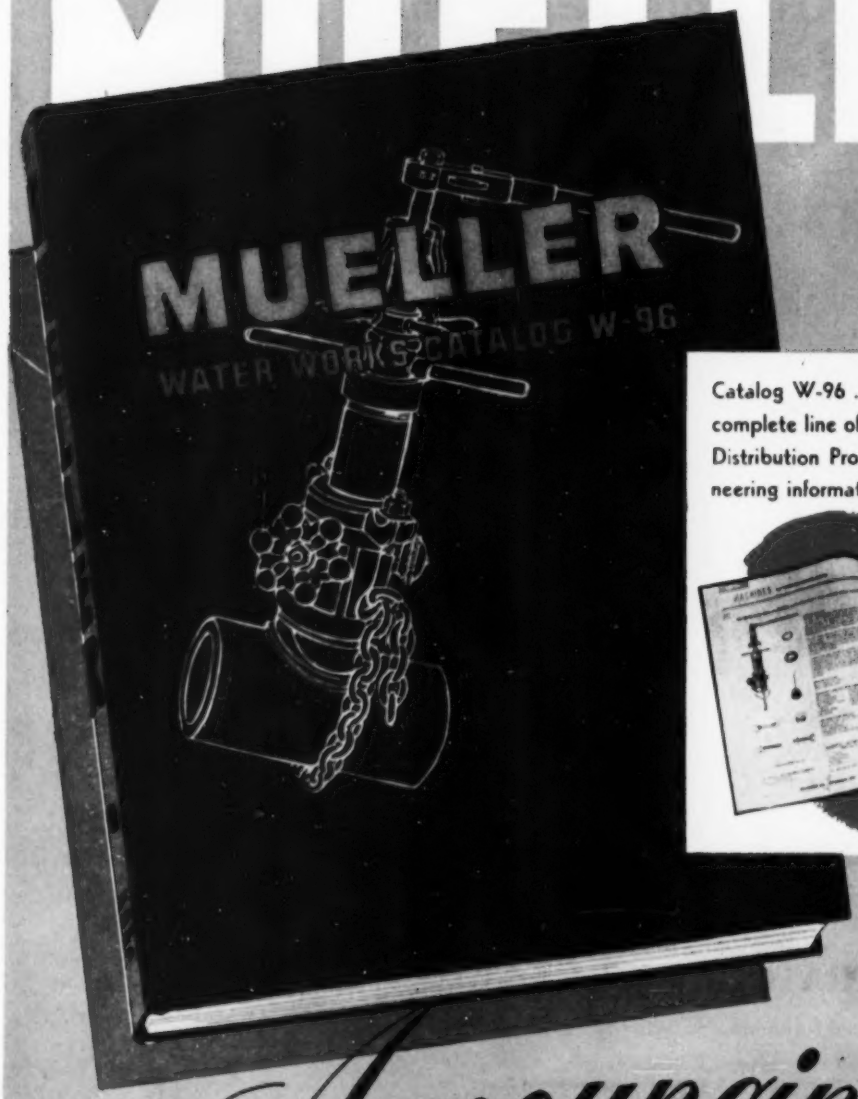
Slow speeds of these De Laval pumps insure long life, large passageways reduce clogging and nickel-chrome cast iron casings and impellers assure long wear.

Baltimore is another of a long list of cities being served by De Laval pumps. A complete centrifugal pump line is built on 50 years experience at De Laval—pioneer in the municipal pumping field.

DE LAVAL *Sewage Pumps*

DE LAVAL STEAM TURBINE COMPANY
824 Nottingham Way, Trenton 2, New Jersey

MUELLER



Catalog W-96 . . . 328 pages . . . the complete line of Mueller Water Works Distribution Products and useful engineering information.

Announcing

the new Mueller Water Works Catalog

A new Mueller Water Works Catalog will be sent to you during the month of November. If you are in need of additional copies, drop us a line or contact your Mueller Representative.

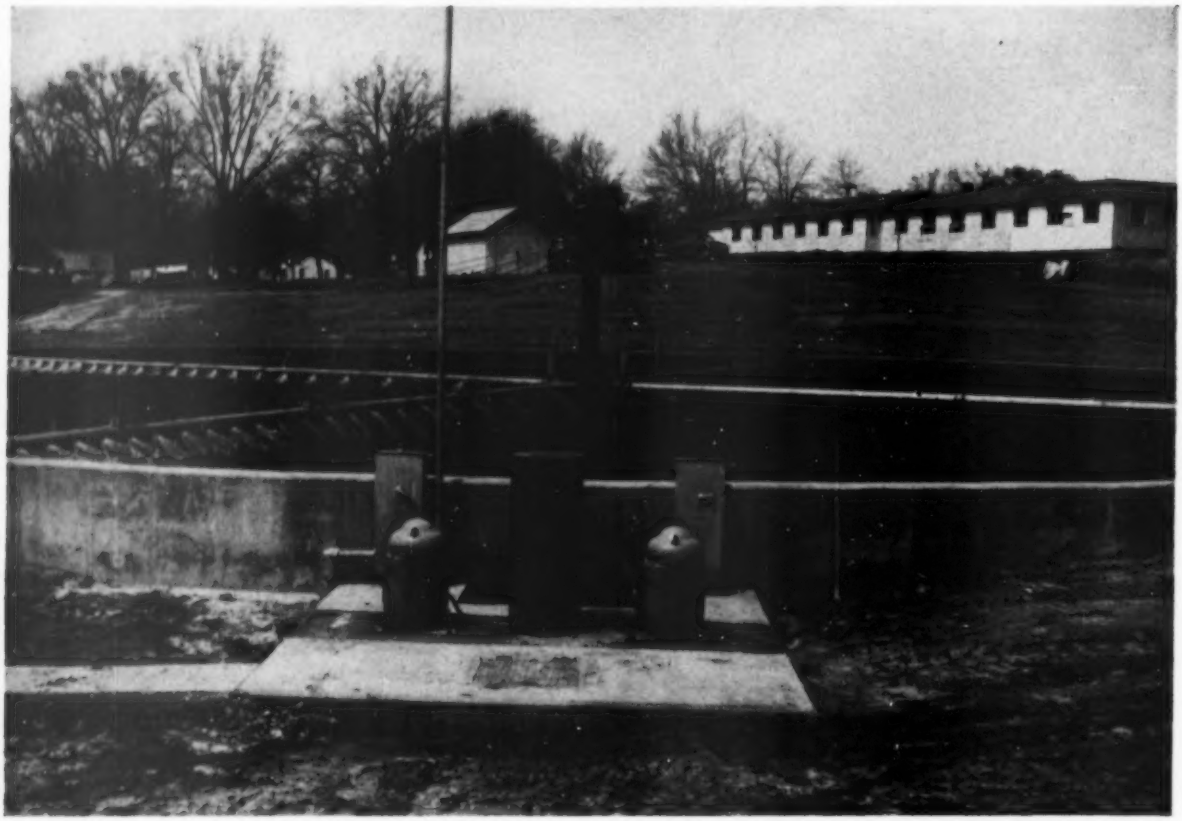
Write Dept. A-36

MUELLER CO.

Dependable Since 1857

MAIN OFFICE & FACTORY DECATUR, ILLINOIS

Critical Jobs Are Routine for Johnston Pumps!



TAKE BIOFILTRATION, FOR EXAMPLE...

Here are two Johnston Propeller Pumps recirculating effluent to the trickling filter and dosing tank at the rate of 2300 gallons per minute in a new sewage treatment plant in Jacksonville, Illinois. Normally these units operate individually but, when needed, both will run at the same time to take care of overloads or other emergencies.

There are many reasons why Johnston Pumps were selected for this job. Here are just three:

1. Equipped with stainless steel bowl shafting.

2. Removable aluminum-bronze bowl liner is not an extra-cost item—it's standard on a Johnston Propeller Pump.

3. Discharge elbow holds hydraulic losses to a minimum, while giving the user the advantages of economical construction.

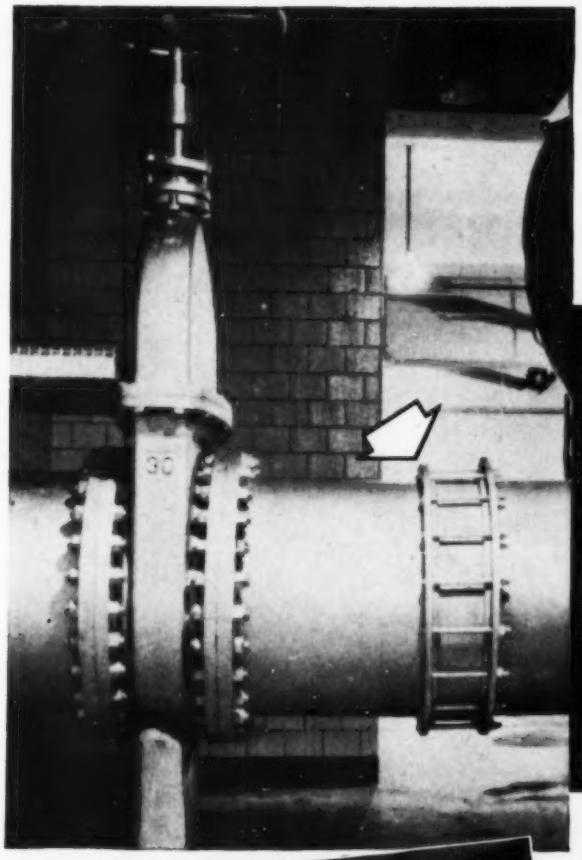
This is another example of the ability of Johnston equipment to handle all kinds of pumping jobs. For the kind of pump "know-how" that puts money in the bank, see your Johnston Dealer, or ask a factory representative to call. They're always glad to help.

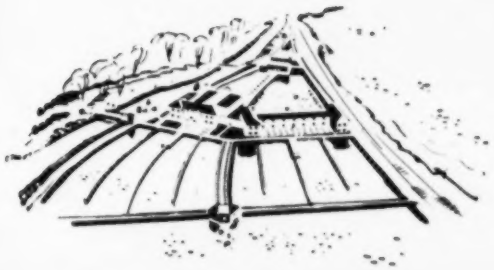
Send today for your free copy of "Flowing Power". Ask for Bulletin K-113

JOHNSTON VERTICAL PUMPS

JOHNSTON PUMP COMPANY

3272 EAST FOOTHILL BLVD., PASADENA 19, CALIFORNIA





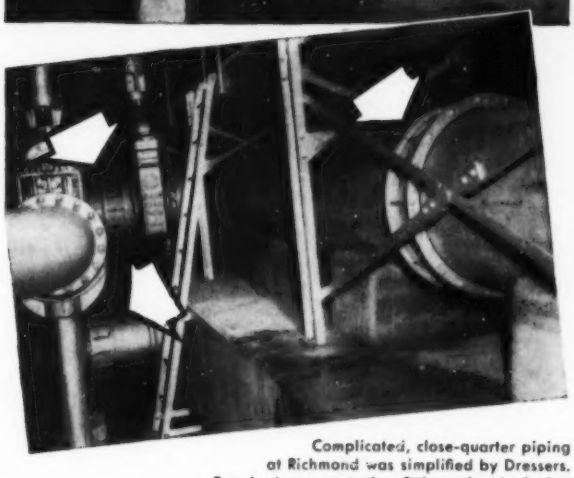
at Richmond, Virginia...

DRESSER COUPLINGS *Safeguard Big Valves*

Marsden C. Smith, Richmond's Chief Water Engineer, writing in *Water & Sewage Works*, says, "The design of the large valves controlling the filters in our No. 2 Purification Plant has been greatly improved by the use of 'plain ends' connected by flexible couplings. This eliminates dangerous stresses on the valve bodies, due to expansion and contraction, and also provides a simple means of replacing the valve, or its removal for repairs."

Dresser Couplings make big-pipe installations easier, faster . . . even in close, cramped quarters. Dressers can give or take as much as 3/8", deflect as much as 4° or more.

Dresser Couplings eliminate expensive maintenance . . . assure lifelong dependability.



Complicated, close-quarter piping at Richmond was simplified by Dressers. Required no exact pipe fitting, absorbed pipe movement without leakage.

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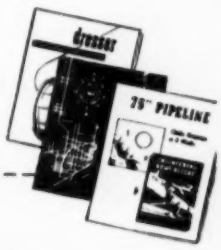

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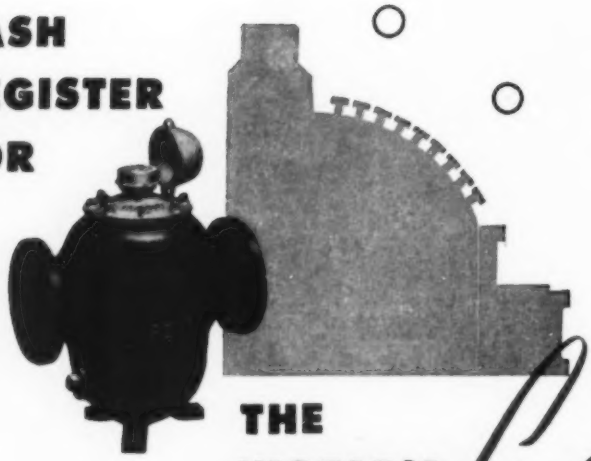

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WATER & SEWAGE WORKS

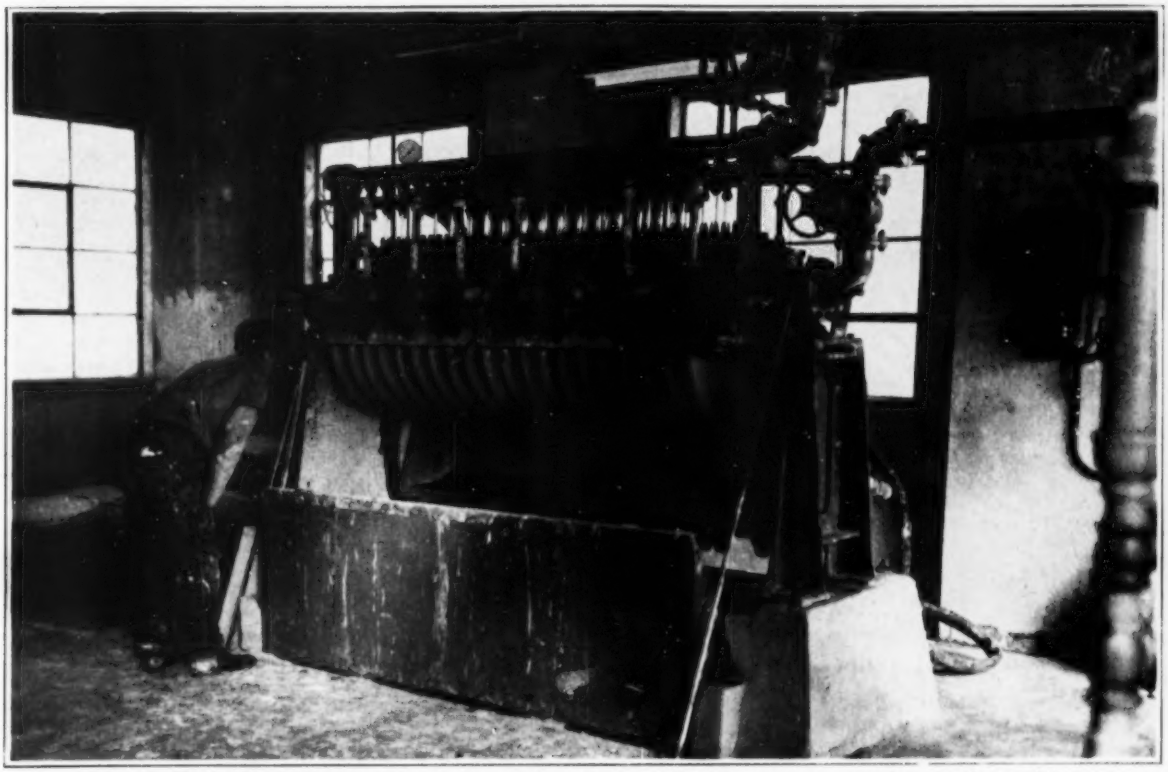


Fig. 1—PRESSURE FILTER (Sweetland type) in operation at Locke waste treatment plant, Baltimore, Md.

Charting a Course for the Future of Stream Pollution Control

How Shortcomings in Present Practices Serve to Predict Areas Where Emphasis Is Needed

by **KENNETH S. WATSON**, *Coordinator of Waste Treatment, General Electric Co., Schenectady, N.Y.*

WIDE-SPREAD, active and realistic efforts to control pollution in the streams of the nation are relatively new. As is the case with any new science, the tools and techniques by which this control is being brought about are in the development stage and thus are open to improvement. Perhaps it would be productive to evaluate the shortcomings in present pollution control practice; by so doing, we can set up guideposts to certain areas where the greatest effort should be spent in the immediate future to permit the pollution control job to be done on a sounder and more economical basis and with a minimum of effort.

The pollution which must be controlled has its origin primarily in the discharges resulting from municipal and industrial activities, and in the solids produced by rainfall which erodes surface areas. Present trends indicate that in the future development of most industrial, municipal and individual enterprises, consideration must be given to the availability of adequate water of the proper quality and to the protection of the water resources against unreasonable pollution; they indicate also that it is timely to take a constructive look at clean stream efforts now in effect.

Mr. Watson's paper is based on a talk presented at the 1953 Industrial Waste Conference at Purdue University.

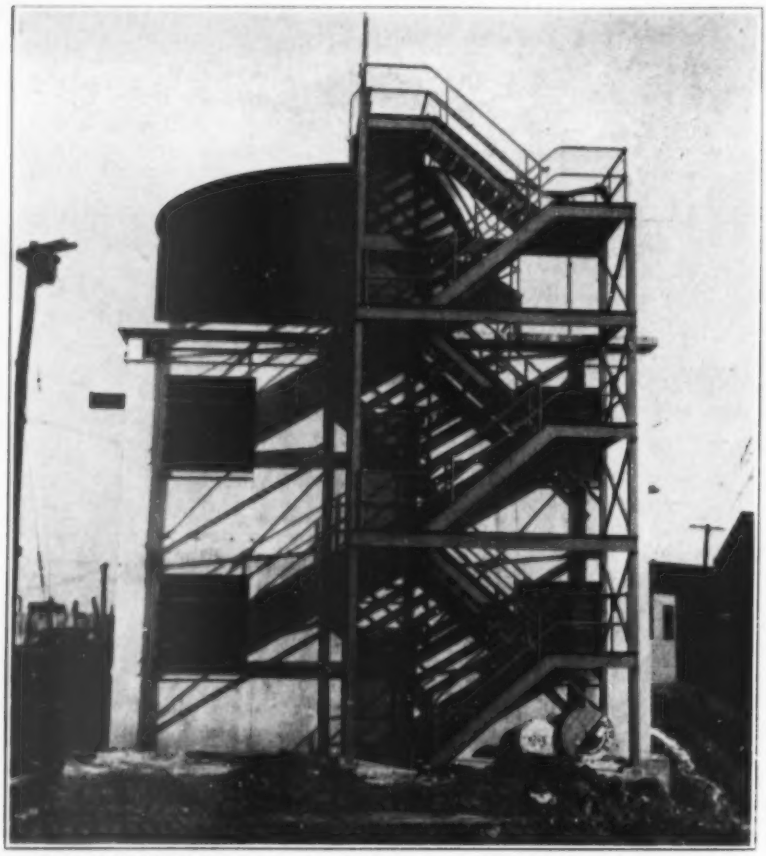


Fig. 2—INDUSTRIAL waste treatment plants may not resemble sewage treatment plants
Installation at Locke Plant, General Electric Co., Baltimore, Md., to remove clay and glaze solids. This plant has Dorr clarifier on top of building. Effluent is discharged to the Patapsco River.

In such an evaluation of the techniques of pollution control practice which could stand improvement, with which the remainder of this paper will be concerned, very little consideration will be given to the effect of solids eroded from the land. This type of pollution is being left out of consideration because most authorities agree that it is of the least immediate consequence of the three main types already mentioned. Similarly, since municipal sewage treatment practices are older, and the treatment techniques are reasonably standard, the impact of sewage treatment on pollution control practice will be given less consideration in this article than will the newer industrial waste treatment field.

The industrial waste treatment installation at the Locke Department Plant of the General Electric Company in Baltimore, Md., is illustrated in Figs. 1 and 2. This installation is representative of the type of facilities which modern industrial plants are providing to permit the discharge of a satisfactory effluent.

Integration of Water Usage and of Waste Control

The recent necessity for industry to protect the water resources of the nation by control and treatment of its liquid wastes leads to speculation as to whether or not industrial plants should more completely adopt the procedure of integrating all water operations. It now appears that the day has arrived when it no longer is sound to think of water supply and usage on one hand and of waste control on the other. We are living in an age that demands control over water entering the plant, its passage through plant operations and its ultimate discharge. Since this is the case, waste control can most expeditiously be handled by personnel having integrated responsibility for the entire water usage cycle. To effectively meet the needs of the future, more plants will need to centralize responsibility for the complete control of water from the influent to the effluent.

Control of water is dictated also by the consideration that the water resources of the nation are not inexhaustible, the wastage of water is inexcusable and the conservation of water is a sound cost reduction step. Furthermore, clean water should be kept out of the sewers by industry as an economy step—there is little reason for providing expensive waste treatment capacity or paying a sewer service charge for unpolluted water. The relationship between the water consumption of the plant and the waste treatment capacity which must be provided again calls attention to the need for industry to adopt the sound water management principles already stressed.

Evaluating the Waste Problem of Industry

Since industrial waste treatment is new, there is a rather prevalent tendency on the part of industrial and consulting engineering personnel to attempt to solve waste problems without first determining the exact magnitude and scope of the waste load in question. This tendency is a natural one since everyone wants to solve a problem in the simplest manner, and many waste definition surveys consisting of considerable sampling and analyses are complex.

By over-simplifying the approach to this problem and failing to make a thorough waste definition survey, however, waste treatment in many cases is being made more expensive than necessary. Overdesigned facilities are not beneficial to anyone. Oversized and improperly designed facilities represent an unnecessary financial burden to industry which must ultimately be passed along to the public in increased cost of product. Satisfactory waste treatment is fast becoming accepted as another cost of manufacturing.

It is a modern concept that the surface waters resources of the nation must be preserved and protected. The absence of a great backlog of experience in the industrial waste field indicates that, to accomplish this, more of the nation's larger plants should have personnel schooled and experienced in handling industrial waste problems. Since smaller plants cannot justify the employment of such specialized personnel, consulting engineering organizations should strive to develop or employ personnel fully experienced in every aspect of the control of industrial wastes.

A larger number of fully qualified and competent specialists in the industrial waste field would insure that such problems were being solved in the simplest and soundest manner.

Ohio Water Pollution Control Bd. Photo

Fig. 3—OHIO'S mobile laboratory for stream pollution surveys

In the picture are F. H. Waring, Chief Engr., Dr. John D. Porterfield, Director, and George Manos, Chemist, Ohio Dept. of Health.

This approach can be briefly outlined as follows:

1. Define the problem.

2. Reduce it to the maximum economical extent by within-the-plant, short-of-treatment steps.

3. Treat the waste load remaining by the use of soundly designed facilities.

Stream Conditions are the Important Consideration

Most authorities in the pollution control field now agree that the proper basis for evaluating pollution is the extent and magnitude of its objectionable effect on the receiving stream. Since it appears that stream conditions will increasingly become the criteria by which pollution will be controlled in the future, then one of the greatest deterrents to getting ahead with the job is the fact that most areas are woefully lacking in analytical information concerning conditions in the stream.

It would appear that the development of analytical information covering stream conditions will remain primarily the responsibility of the State control agencies. A number of states, among which are West Virginia, Ohio, and New York already are busily engaged in determining actual stream conditions as the basis for a realistic program of protecting and improving these waters. These states and others expediting their stream definition work by the use of completely equipped trailer laboratories which can be towed to the area under study. One of Ohio's modern trailer laboratories used for stream and pollution control surveys is illustrated in Fig. 3.

The location of the laboratory adjacent to the streams being sampled greatly reduces the cost involved in transporting samples and improves the accuracy of the work. Much more stream definition work of this type is necessary, but most state agencies are moving slowly in this field as a result of lack of funds and personnel.

Yardsticks for Measuring Effect of Pollution

Since it appears that, in the final analyses, stream conditions will determine how much treatment a particular waste must be given, it then follows that accurate tools are necessary to evaluate true stream conditions and the particular effect of each particular type of waste on the stream.

Perhaps it would be wise to consider briefly what is meant by stream conditions. In dealing with pollution control, this term should ordinarily be taken to mean the condition of the water in the stream intended to serve as a source of municipal and industrial water supply. Stream conditions would also mean the condition of the water in the stream intended to support aquatic and animal life, serve as a recreational facility, and support agricultural activities.

If stream conditions have been properly defined, then our present tools for determining water and effluent conditions apparently are relatively crude. The complete fitness and safeness of surface water for human consumption should carry great weight in evaluating stream conditions. In spite of this fact, no very comprehensive work has been done regarding the detrimental effects on the human system of trace amounts of metals, chemicals or other materials consumed in drinking water.

The threshold limits of acceptable concentration of various materials listed in the Public Health Service Drinking Water Standards are the most widely applied information in this field. These standards are excellent insofar as they go but they could stand considerably more research support and could be expanded to cover other applicable materials.

It would appear, therefore, that since the highest use of surface water is human consumption and the health of the people of the nation is of great consequence, that many more projects should be underway to determine at just what concentration various materials in water begin to be objectionable to human life.

The layman's method of determining stream conditions is observing whether the stream appears clean, and whether or not it will support aquatic life. Pollution control agencies also depend upon these same criteria but they have more refined tools with which to work. Thus far, the control agencies have depended more upon chemical and biochemical rather than upon biological methods of evaluating stream conditions.

It would appear that evaluating the suitability of a stream for aquatic life is sound; if the water is satisfactory to fish, the chances are good that it also will be satisfactory for human use. Again, however, the tools for evaluating the liking of fish life for a particular water could stand great improvement. Agreement is poor in the literature as to how much concentration of various types of ma-

terials can be tolerated by various species of fish.

Those professionals in the field, who feel that the biology of the stream is of great importance in determining true stream conditions, have a strong point but the techniques for evaluating stream conditions based upon its biological climate have apparently been too time consuming to date to be widely applied. It would appear, therefore, that both the chemical and biochemical and the biological approaches have good application in the definition of stream conditions but much more work is necessary both on chemical limits and on a relatively simple biological technique for checking stream conditions.

Needs for Instrumentation

More information on a continuous basis covering stream conditions would greatly expedite pollution control work, and it would appear that this should constitute a challenge to the country's instrument manufacturers to develop automatic analyzing, recording, and monitoring devices to serve this area. Devices which could be installed on the pier of a bridge and automatically record water conditions would greatly simplify pollution control work. Reasonably priced instruments of rugged construction, which could determine and record dissolved oxygen, biochemical oxygen demand, and the concentration of toxic chemicals and metals would be in great demand in the pollution control field. Such instruments would be valuable not only in stream survey work but would aid greatly in defining effluent conditions.

Another area which should provide food for thought for the instrument makers is that of devices which will proportion the feed of treatment chemicals to the concentration of the impurity requiring treatment. A proportionment of the chemicals to the load eliminates imperfections of manual control, reduces chemical wastage, and insures that sufficient chemical always is present to properly react with the impurity to be treated. The recent refinement of the Redox oxidation-reduction cell to the feeding of reducing agent in the treatment of chromium is an example of the type of instrumentation for which there is a need. The recorder portion of the Redox oxidation-reduction controller suitable for feeding reducing agents in treating chromium wastes is illustrated in Fig. 4.

Another need for instrumentation to regulate the feed of chemicals to the concentration of impurities is in the alkaline-chlorination of cyanide

Fig. 4—REDOX recorder controller

wastes. It is understood that, by the use of the oxidation-reduction principle, proper electrodes have now been developed by some manufacturers to proportion the feed of chlorine in this type of treatment to the concentration of cyanide to be treated.

These are but two examples of specific cases where treatment is being refined by proper instrumentation. There are other cases where similar developments would greatly add to the science of treating industrial wastes.

Equipment Modification

In considering equipment to serve the waste treatment field, another area readily comes to mind. It would appear that many of the major items of equipment used in the water supply and sewage treatment field could be used in the waste treatment field, after some modification had increased their applicability to this newer field. In the modification of equipment to more suitably serve the waste treatment field, considerable room for improvement is indicated.

Apparently the attitude has been too prevalent that equipment which has stood the test of time in water and sewage applications will serve equally satisfactorily in waste treatment. In some instances and with some types of waste this philosophy is correct. In many instances, however, a more progressive outlook might be to determine by a sound research program how this equipment should be modified or redesigned to do a more satisfactory industrial wastes job. Such an outlook would no doubt advance the art of waste treatment and reduce the ultimate amount of money which must be spent to do this country-wide industrial waste treatment job.

Better Bacteriological Technique

Almost everyone who works in the pollution control field is at times disturbed by the amount of effort and time that must go into coliform tests in order to evaluate bacterial pollution resulting from the discharge of sanitary sewage. Coliform determinations have served in an excellent manner for evaluating drinking water quality, but are laborious for pollution control work. Efforts on the part of the State Health Departments and of the U. S. Public Health Service to simplify and standardize the extent to which this determination must be confirmed to be acceptable for pollution control work represent a contribution.

Experimental work is being done in Illinois to determine the extent to which a stream is polluted by using standard coliform results along with the most probable number of enterococci present. These studies might be a harbinger toward the development of a more suitable method.

It appears that there is still a challenge to bacteriologists associated with the field to come up with a less involved method of measuring bacterial pollution from human beings. In the process, it would be quite helpful if a technique could be developed which would eliminate some of the field refrigeration and laboratory gear necessary to run bacteriological analyses.

Educational Needs

Pollution control and waste treatment are making rapid strides forward. To insure continuity of progress, the professionals in the field along with the nation's educators should probably be directing some effort in the direction of insuring that young men are being properly educated to cope in the most effective manner with the problems in question.

Conventional sanitary engineering tools are not enough to handle every phase of this expanded field. In industrial waste treatment, the tools of chemical engineering have great application but the chemical engineer is

not completely at home in a sewage treatment plant. In the highly important field of stream surveys and the setting of treatment standards, conventional sanitary and chemical engineering courses provide a background which is not completely adequate. No simple answer has apparently been developed to date but this subject is certainly worthy of serious thought.

Perhaps as a beginning, toward facing up to this educational challenge—which already is in effect in some schools—young men interested in sanitary engineering might be encouraged to study more chemistry, bacteriology, and biology to more fully qualify them for the field of pollution control in its broadest aspects. At the same time, the chemical engineering schools could give more recognition to the field of waste treatment and could encourage the interested students to study more sanitary engineering, bacteriology, and biology subjects.

Summary

It is hoped that no impression has been given of being overly critical or cynical. In fact, in quite the contrary vein, it is intended to suggest that the broad field of pollution control, although suffering from growing pains at present, has great future potentialities. This article represents the author's effort to stand aside from the daily involvement with all the details of his chosen field, and be objective regarding some of the areas in which improvements should be made.

For the field of pollution control to grow in a manner which qualifies it to solve all the related problems, much more objective thinking must be given to the subject by those specializing in the field. As a result of the author's experience and thinking in the field of pollution control, it appears that to cope with the needs of the future, the area in which we work should be improved in the following particular respects among others:

1. Industrial plants should give more consideration to control of the entire water cycle from influent to effluent.

2. Industrial plants and consulting engineering firms should develop or employ more personnel schooled in defining and reducing an industrial waste problem by within-the-plant, short-of-treatment steps.

3. Much more analytical information covering actual stream conditions all over the country is necessary.

4. Better methods for determining when a stream is polluted are quite important to evalute the effects of polluting materials on the human system and aquatic life, if the clean stream efforts are to proceed on a completely sound and orderly basis.

5. Improved instruments and instrumentation would be of great help in defining stream and effluent conditions.

6. Instrumentation which will more fully proportion the feed of chemicals to the concentration of impurities requiring treatment will be an asset in almost every branch of the industrial waste treatment field.

7. Modification and redesign of many of the major items of equipment used in water and sewage treatment, to better serve the waste treatment field, should expedite progress in this area of operation.

8. A streamlining of the coliform determination as applied to pollution control, or the development of a more rapid procedure using a different organism, should simplify pollution abatement work.

9. Mature consideration is warranted by the question, are young men entering the pollution control field today equipped by the best educational background available to cope with the many problems which it presents?

Testing After Explosion Stops Sewer Project

Man is killed before danger from fumes is recognized

Work on a section of the Bayonne, N. J., sewer project was stopped recently by order of the police and fire department.

Testing with an explosive meter after a workman was killed in an explosion and fire in a pit, fire officials found the atmosphere was such that it was in the explosive range.

The explosive fumes, filling the pits and excavations for the 60-inch mains, is from petroleum seepage.

The ground was saturated with the petroleum during the years it was occupied by the Gulf Oil Co.

Now as openings are made in the ground, fumes escape and threaten the workmen.

Texas Extension Courses in Water Works Revised

The Engineering Extension Service of Texas A & M College has recently revised its courses for training water works operators in the state. This revision is a result of study and discussion by representatives of the Water and Sewage Works Assn., State Health Dept., and A & M College system.

Now offered for men employed in the supervision, operation and maintenance of water systems are the following courses, each of 20 hours credit:

I—Basic water works operation.
II—Advanced general operation.
III—Well production.
IV—Surface production.
V—Water distribution.

For further details address: I. N. Ronhovde, Chief Instructor, Water and Sewage Works Operation, Texas Engineering Extension Service, Box 236 F.E., College Station, Tex.

Water Pollution Control Act Extended to 1956

Congressional action has made the Water Pollution Control Act, PL 579, effective to 30 June 1956. An appropriation of approximately $1 million was made to provide for the construction of pollution control programs by the states in cooperation with the U. S. Public Health Service. Research into water pollution control will be spurred by the opening of the newly-completed and staffed $4 million research center in Cincinnati designed to investigate new, cheaper, and more effective ways of disposing of sewage and industrial wastes.

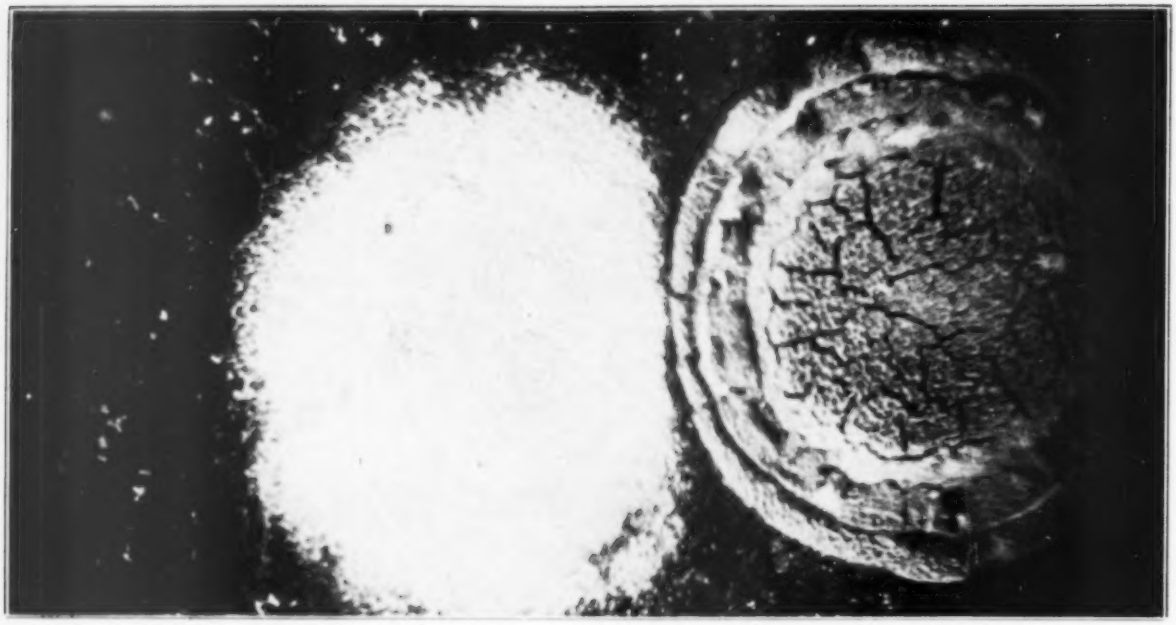
J. S. Williams

E. O. Potthoff

A Photo Correction: Williams and Potthoff

In the third installment of our report on the A.W.W.A. meeting in Grand Rapids, we reviewed papers presented by Messrs. Williams and Potthoff. We regret that the photos of these two speakers in the September issue, page 345, were incorrectly captioned.

Above, correctly designated are photos of J. S. Williams, Vice-Pres., Automatic Control Co., St. Paul, Minn., and of E. O. Potthoff, Application Engr., General Electric Co., Schenectady, N.Y.



ACTINOMYCETE colony formation of two varieties on agar

Newer Concepts of Tastes and Odors in Surface Water Supplies

The First Article of a Series

by **J. K. G. SILVEY**, *Director, Biology Dept. and Chm'n. Science Div., North Texas State College, Denton, Texas.*

ONE of the earliest authentic records of the occurrence of algae in water, and their relation to tastes and odors, may be found in the French literature of 1846[1].

In America attention was called to the presence of these minute plants in water at about the same time that water supplies were first taken from polluted streams. Although algae have been present in various rivers, lakes, creeks, and springs for many thousands of years, their significance in producing tastes and odors was not interpreted by water works personnel until the latter part of the nineteenth century. From these observations one may conclude that certain tastes and odors in water supplies were thought to arise from algae or algae by-products. Usually the water supplies containing taste and odor compounds were derived from rivers or reservoirs that received various types of wastes from populated areas. The re-use of water, even though highly diluted, contributes fertilizing materials that result in greater populations of algae; and, as has been observed in the past, greater and greater accumulations of taste and odor producing compounds.

The early investigations seeking the causes of tastes and odors were centered around the East Coast. Industry had become established on rivers sufficient to supply them with the required amount of water for the production of whatever commodity they were manufacturing. As a result, the rivers were sufficiently contaminated with various types of materials that induce the growth of a number of varieties of algae. Jackson and Ellms[2] observed a bloom of *Anabaena*, (one of the bluegreen algae), and noted the high intensity of tastes and odors in the water supplies in certain parts of Massachusetts. Their monumental work labeled this organism as the direct cause of the offensive tastes and odors. Whipple [3] in his classical work on water supplies went so far as to list specific organisms, the types of odor they produced, and the means of control. The most extensive work in this field, however, was carried out by Dr. Frank Hale in connection with the New York City water supply[4]. As a result of these early investigations the botanists in cooperation with the water works men sought to find means or methods of controlling the algae and, as a consequence, reduce the concentration of taste and odor producing compounds. It is interesting that in all of the work that has been executed in this field there are no specific references to detailed cultural techniques that result in chemical isolation of specific compounds that produce tastes and odors that are commonly found in water supplies.

In 1935 we undertook an investigation on Texas reservoirs[5] we had hopes of being able to follow algae cycles, and to account for chemical compounds or the physical factors that contributed to such algae cycles and to isolate the organic chemicals or compounds responsible for the attending tastes and odors. In a period of

five years we were able to follow the algae cycles in Texas reservoirs and note that the greatest single factor in the production of algae blooms was the available soluble phosphate content of the water. In certain instances we were inclined to think that the available soluble nitrogen compounds contributed somewhat to the more excessive growths of algae, but noted that the absence of phosphate caused an immediate reduction in the total algae in the reservoir. Possibly the most interesting observation in this five year investigation was the fact that tastes and odors did *not* appear coincidental with high concentrations of algae. As a matter of fact, tastes and odors did not appear until the algae blooms had passed their peak and began to recede. At that point in the cycle the intensity of odor would rise and for several weeks following the algae bloom the threshold odors in the water would continue to increase and on certain occasions would remain in the water for as long as two months after the algae had settled to the bottom of the reservoir.

A Clue for Further Investigations

These early observations gave us a clue for further investigations concerning the actual causation of tastes and odors in water. In the Southwest there appeared to be two major groups of algae occurring in blooms. One of these was a diatom belonging to the genus *Melosira* and the other was a bluegreen algae belonging to the genus *Anabaena*. Other forms of algae were also present in the reservoirs, but never in sufficient quantities to be of sanitary importance. Not until 1938 were we able to obtain pure cultures of *Melosira*. These were reared in the laboratory in bacteria free media for a period of two years. Even though the concentration in the cultures rose above those concentrations found in the reservoirs we were never able to get any odors in the water other than those of algal decomposition. We could never produce the musty, hay-like, earthy, or manurial odors found in reservoirs containing unusual blooms of *Melosira*. We were not able to get pure cultures of *Anabaena* although we could raise it in the same media with *Melosira*, and generally bacterial free. The only odor we could get from those cultures was on decomposition and in such instances it was distinctly putrefactive and did not in any manner resemble the tastes and odors found in the surface water supplies vitiated with objectionable tastes and odors.

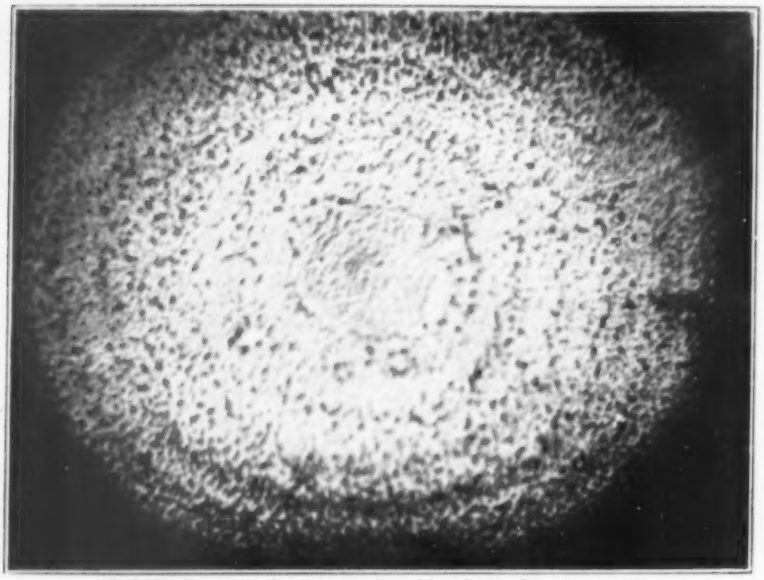
Our research on tastes and odors in water was of necessity reduced during wartime but was reinstituted again in 1945. In cooperation with the Texas State Health Department and through a grant-in-aid from the National Institute of Health we renewed our studies[9] on water supplies, using as our reservoir for investigations two lakes that had a history of tastes and odors and two lakes that did not have a history of tastes and odors. After a period of two years we were confronted with a mass of rather revealing data. Two of the lakes that had tastes and odors were *completely unlike* in their algae populations. One exhibited sporadic blooms of algae, particularly in the spring or early summer. As the algae blooms abated tastes and odors arose. Again the algae were *Melosira* and *Anabaena*. The other reservoir that also contained high concentrations of taste and odor compounds was too turbid to develop algae. It did possess a luxuriant growth of emergent types of vegetation such as cattails, eel grass, and wild rice. The other two lakes in the investigation did not produce tastes and odors although they had a rather high concentration of algae. The algae that they produced were not members of the genus *Melosira* nor the genus *Anabaena*. Instead they were common unicellular green algae, some of which existed as single cells, some as filaments, and others as plate-like colonies.

Turbid Algae-Free Lake Provides Clues of Importance

We could see from the investigations, so far, that either of these two specific algae would produce specific odors in the presence of bacteria or other organisms, while certain algae regardless of their association did not appear to produce any tastes and odors. On continuing the investigation we were confronted with a problem of interpreting the one lake in our investigation that had no algae but at the same time contained high threshold odors in the raw water. We chose this surface water supply (Lake Waco, Waco, Texas), for detailed investigations.

Samples of rooted vegetation, water, and numerous samples of mud

ACTINOMYCETES viewed under high powered microscope, at colony edge



SPORES begin to form in 24 hr. old colony of actinomycetes

from Lake Waco were examined microscopically. Although these samples contained intense odors similar to those found in the surface water, we could not detect any organisms that could be considered responsible for the taste and odor compounds. Consequently we resorted to simple bacteriological techniques. Samples of water, mud, and pieces of vegetation were placed on a variety of nutrient media containing an agar base. The incubated plates became covered with bacteria, yeast, and mold but no odors appeared which were similar to those found in the water and mud of the lake. The plates were cleaned, resterilized, and other samples were plated out time and time again. Near the end of August the laboratory was closed and a few of the plates were left uncleaned.

A Chance Discovery Opened the Door to a New Approach

Near the middle of September when the laboratory technician was examining the uncleaned plates before discarding them, she discovered that they emitted the odors that we had been striving to isolate. In addition, there were numerous small dry colonies on the dry agar. Transfers from these small colonies resulted in the growth of organisms that produced the taste and odors that we had noted in surface supplies for over a decade. The organisms were actinomycetes belonging to the genus *Streptomyces* and they were readily cultured on nutrient agar or on other types of nutrient media as will be explained in more detail.

The actinomycetes that were isolated from Lake Waco appeared to be growing either on living types of higher vegetation or on the remains of vegetation embedded in the upper layers of the mud. By some means these organisms were liberating organic compounds which were diffusing into the water and ultimately finding their way into the filtration plant. The spores of this particular actinomycete were so small (.2x.6) that they passed through the filtration plant and out into the distribution system. There were sufficient nutritive compounds on the interior walls of the water mains to support small colonies of the actinomycetes. This accounted for the increase in the amount of tastes and odors in the water the further it traveled through the distribution system. In order to have some concept as to whether these organisms were aquatic or terrestrial we attempted to rear them under conditions commonly used in rearing terrestrial types of actinomycetes. The forms did very poorly. When the moisture content of the media was increased the actinomycetes grew profusely. Spores of these forms placed in water survived a period of sixteen months and probably would have survived longer had our original samples been larger. Later experimentation, as will be illustrated, pointed to the fact that we had isolated a group of actinomycetes that were specialized for an aquatic existence and that, although they resembled soil forms, their requirements were such as to limit them to growth in water.

What are These Actinomycetes?

By way of explanation one should state that the actinomycetes are also known as ray fungi. These forms are closely related to the bacteria as well as to the fungi. They are, however, differentiated from the bacteria on regular cultural plates by the fact that the colonies on synthetic media have a dull lusterless appearance and may be either smooth or wrinkled. They are tough and leathery and often show minute filaments growing above the media—see illustrations. On all types of media the actinomycetes produce earthy, hay-like, or manurial odors. We noted from the literature that over fifty years ago Rullman[7] had described aquatic actinomycetes that produced a pungent odor that he described as earthy. Adams[8] also cited the earthy taste in potable waters that had been filtered from the Nile River as the source of supply. Thaysen[9] had investigated the aquatic actinomycetes because of their ability to impart tastes and odors to the flesh of salmon caught in the Thames River in England. The most complete prior work on these organisms was done by Issatchenko and Egorova[10] in their investigation of Moscow River. Their conclusions, however, noted that terrestrial actinomycetes had migrated into an aquatic environment and continued to impart the odors.

The major contribution of our investigations[6] to that date had been the fact that we were able to show the cause of tastes and odors in a water supply that did not contain algae, and although our observations pointed to the fact that the taste and odor compounds were identical to those found in other reservoirs, it was necessary to find proof. Consequently, we began a new investigation involving both laboratory and field research. The actinomycetes were reared in the laboratory on synthetic culture media and the by-products produced were isolated by extraction and distillation. At the same time lakes were investigated that supported blooms of algae and particular attention was focused on blooms as they began to abate. The water was then collected from such reservoirs in ten-gallon cans and run through activated carbon columns in an attempt to accumulate the taste and odor producing compounds and find if they were identical to those isolated from the synthetic culture media on which we were rearing actinomycetes. In other words, we deemed it necessary to prove that the taste and odor compounds in other reservoirs were the same as those in Lake Waco. The compounds adsorbed on the carbon were desorbed and compared to the compounds removed from the media in which actinomycetes were growing. They were shown to be the same sub-

stances although concentrations were variable depending upon the reservoir under investigation.

Algae Host to Actinomycetes

If the taste and odor compounds were the same in several reservoirs and if they were identical with those produced by Waco actinomycetes, then we should be able to find where the actinomycetes were growing. We presumed that if aquatic actinomycetes would grow on higher vegetation they would probably grow on or in algae. It is well to make assumptions but in such investigations it is essential to have proof. We started this work by going back and investigating *Melosira*, the diatom that we had observed since 1935. It was collected from Lake Ranger and Lake Dallas, concentrated and plated out on double strength nutrient agar. A series of such platings gave us little or no information. A mixture of *Anabaena* and *Melosira* were collected from Lake Ranger in the summer of 1949. Attempts to culture actinomycetes from these algae were unsuccessful. For a period of two years wherever algae blooms occurred we concentrated the algae and attempted to grow actinomycetes on various types of nutrient media. In the summer of 1951 while working on Lake Hefner, a part of the Oklahoma City water supply, we accumulated some growths of green algae belonging to the genus *Cladophora*[10]. Lake Hefner had shown episodes of tastes and odors from time to time and by the summer of 1951 the cause of these so-called "algae odors" was still unknown. Samples of the *Cladophora* were returned to the laboratory and were plated in the same fashion as the other algae had been investigated. No actinomycetes resulted from this experimentation. The laboratory technician placed a small vial of the *Cladophora* in the freezing unit of the refrigerator and permitted it to remain for twenty-four hours. This action was a mere oversight. At the end of that period she removed the container from the freezing unit, permitted it to thaw, and plated out the fragmented filaments. This resulted in the growth of thousands of minute colonies of actinomycetes. In order to be certain that contamination had not occurred, new samples of the *Cladophora* were brought from Oklahoma City to the laboratory, placed in small glass homogenizers and crushed. Cultures made from the algal remains contained thousands of colonies of actinomycetes belonging to several genera of aquatics. With this experience behind us we reinvestigated the two genera of algae that we had associated with tastes and odors in water. Samples of *Melosira* and *Anabaena* from various bodies of water were crushed in homogenizers and plated on agar, resulting in multitudes of actinomycete colonies growing on the media. By intensifying the investigation and including other lakes in the Southwest as well as larger streams and rivers we have been fortunate in demonstrating that wherever algae and tastes and odors occur, the algae are being attacked by actinomycetes, resulting in the production of taste and odor compounds that are varied in their chemical nature. From a general descriptive standpoint, one may say that the odors present may be marshy, earthy, fishy, geranium, manurial, medicinal, aromatic, and on certain occasions might be described as chemical.

TYPICAL aquatic actinomycetes, as viewed under high powered scope.

The tastes and odors that occur in surface waters throughout the Southwest have been shown to be due to actinomycetes growing in association with algae, higher plants, plant remains, and in certain instances on animal remains such as fish and turtles. It is possible that the tastes and odors described from water supplies throughout the nation are actually due to the by-products produced by the various genera of actinomycetes in their normal metabolic activity. We thought it important to bring this information to the attention of the water works group with the idea in mind that more detailed information regarding isolation, cultivation, chemical studies and corrective measures may be presented in a series of articles to appear in *Water & Sewage Works*.

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Pennsylvania Operators' Conferences Held at State College in 1953

Presidents—Water Assn.

Incoming
B. F. Johnson
New Castle

Outgoing
L. D. Matter
Harrisburg

NEW OFFICERS
Pennsylvania Water Works Operators' Association

President
B. F. Johnson, Chemist
New Castle Water Co.
New Castle

Past President
L. D. Matter, Ass't. Ch. Engr.
State Health Dept.
Harrisburg

First Vice-President
V. F. Rigling, Div. Mgr.
Amer. W.W. Service Co.
Harrisburg

Second Vice-President
S. P. McBride, Pres.
Trotter Water Co.
Uniontown

Secretary-Treasurer
R. R. Kountz, Prof. San. Eng.
Pa. State College
State College

Presidents—S & IW Assn.

Incoming
T. R. Hazeltine
Pittsburgh

Outgoing
Roy F. Weston
Philadelphia

THE members of two associations, their ladies and guests have found State College, Pa., an ideal location for learning and for relaxation. On Aug. 24-26 the Pennsylvania Water Works Operators' Assn. held its 26th annual conference there, with a registration of 241 men and 84 ladies. On Aug. 26-28 the Pennsylvania Sewage and Industrial Wastes Assn. held its 25th annual conference there, with a registration of 240 men and 45 ladies.

The Pennsylvania State College provides excellent dormitory facilities at a reasonable rate, and all meeting sessions are held in the Temporary Union Building.

The Serious Side

In addition to the technical sessions, the water group held a business meeting to elect new officers, to name the winners of awards, and to report on business details.

One afternoon was devoted to the demonstration of several types of ditch pumps and of pipe cleaning equipment.

The sewage and industrial wastes group held its business meeting, elected new officers, announced awards, and reported on business.

An afternoon session was devoted to inspection of the dairy waste treatment plant in operation at the college, to a visit to the Garfield Thomas water tunnel, and to a sewer cleaning demonstration.

The Lighter Side

Both associations began their meetings with preliminary evening sessions to welcome conference members, and both presented prizes to golf tournament winners.

The water group held a picnic style barbecue chicken dinner in woods on the campus. The sewage and wastes group held its annual dinner at the Nittany Lion Inn. A feature of this dinner was a review of the Association's 25-year history; presentation of twenty-five year members; and the induction of notables into the "Sludge Shovelers Society."

Awards

Presented by the water association were the following:

The I. M. Glace Award to REGINALD B. ADAMS for 1953. This award (a pin, certificate, and money) is awarded to that operator making the greatest contribution to upgrading the status of those in the water works field.

The President's Cup Award to F. W. BAKER. This award (a certificate) is presented to the plant operator submitting the best technical paper. Mr. Baker's paper is titled "Geophone Leak Surveys."

Members are Welcomed

The water conference was welcomed by Prof. E. R. QUEER, Director, Dept. of Engineering Research, The Pennsylvania State College.

This evening session had, as guest speaker, H. E. MOSES, Consulting Chief Engineer, State Dept. of Health, who spoke on the topic "Early Pennsylvania Water Supplies."

The sewage and industrial wastes conference was welcomed by E. L. KELLER, Director, Central Extension, The Pennsylvania State College.

Water Works Assn. Technical Program

L. D. Matter was chairman at the first technical session of the Water Works Operators' Assn. meeting.

President's Award Paper

"GEOPHONE LEAK SURVEYS" were described in a paper presented by F. W. Baker, Manager, The Bangor Water Co.

The water system at Bangor, Pa., was described by Mr. Baker as including separate mains from each of several free-flowing wells—pumping is required only at times of high demand. Bangor has a population of approximately 10,000. Length of distribution mains is 3,000 ft.—both high and low pressure areas (all gravity flow up to 150 lb. pressure). The system dates back to 1886 and services are ¾-in. copper tubing, with some plastic pipe being employed in the last few years.

There are 600 metered accounts,

DITCH PUMPS of various types were demonstrated in an outdoor session

First Vice-Presidents

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S & IW Assn.
Gordon J. Wiest
Devault

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Water Assn.
S. P. McBride
Uniontown

S & IW Assn.
L. L. Gwin
Altoona

Secretaries

Water Assn.
R. R. Kountz
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S & IW Assn.
B. S. Bush
Wilkes-Barre

S & IW Assn.

Editor
J. R. Hoffert
Harrisburg

Director
H. T. Reuning
Johnsonburg

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Pennsylvania Sewage and Industrial Wastes Assn.

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Warner Lime Co.
Devault

Second Vice-President
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N.Y. and Pa. Co.
Johnsonburg

Secretary-Treasurer
B. S. Bush, Dist. Engr.
State Health Dept.
Wilkes-Barre

Editor
J. R. Hoffert, Ch. Engr.
State Health Dept.
Harrisburg

and it was recognized that consumption has recently shown a marked increase. By means of a Geophone listening device, the system was surveyed in the late evening and early morning hours. The survey was made district by district and operators became quite proficient in discovering leaks, locating 250,000 gal. in leaks during the first week. Mr. Baker praised the Geophone for its simplicity—describing it as an extremely sensitive, entirely mechanical device—and recommended its use by small utilities where it is not now available.

Mr. Matter noted that frequently the State Health Dept. is asked by small water systems for permission to use emergency water supplies when, if a leak survey were made, there might be sufficient water available to meet demands.

Operation and Treatment Panel Discussion

Questions on water treatment and plant operation were discussed by a panel comprised of the following members:

L. S. Duckworth (moderator), Filter Plant. Supt., Municipal Water Works, Lancaster.

Martin Flentje, Research Engr., American Water Works Co., Philadelphia.

L. D. Matter, Asst. Chief Engr., State Dept. of Health, Harrisburg.

Samuel P. McBride, Pres. & Gen. Mgr., Trotter Water Corp., Uniontown.

John O. Fulmer, City Chemist, Easton.

Earl C. Kohl, Chairman, Myerstown Water Authority.

Mr. Duckworth started the discussion by asking panel members to report any out-of-the-ordinary recent experiences.

Mr. Flentje reviewed the safety program undertaken by his company during the past year. Its accident rate is high (650 accidents among its 2000 employees), and its insurance costs are $250,000; with a lowered accident rate, some $40,000 could be saved yearly in premiums.

Mr. Fulmer described problems encountered in rebuilding filter units: principal problem was the handling of sand and gravel. The loan of a hydraulic ejector by the city of Allentown aided materially (enabling the pumping of 45 tons of sand in one day). Particularly useful was a lightweight aluminum conveyor having a 6-in. wide track and operated by a ¾ hp motor.

R. B. Adams (Wilkinsburg) recited experiences in the sterilization of main line extensions. The lack of success led him to ask the panel members for advice, especially with regard to two questions:

1. What constitutes good practice for keeping pipe clean in storage?
2. What is a practical procedure for disinfection?

Mr. Flentje: Flush newly laid pipe *hard*; and *don't* take bacteriological samples!

Mr. Fulmer: Swab pipes before laying.

Mr. Kohl: No special precautions are needed in pipe storage.

Mr. W. C. Ringer, Jr. (Philadelphia): Large pipe should have ends covered in storage, to protect against animals rather than dirt. Small amounts of clay in newly laid mains may confuse bacteriological tests.

Mr. W. W. Brush (New York City): A more serious view should be taken of the need for main sterilization. The example was cited of improperly cleaned new mains which caused some 8,000 cases of dysentary (these mains were laid in close prox-

PIPE CLEANERS in operation and under discussion

Photos by W. C. Ringer, Jr.

BARBECUE chicken dinner served from the pits in Hort Woods on the campus—"Certified Turners" at work!

inity to sewer lines). While the mains had been flushed and disinfected—and passed on the basis of a 48 hour bacteriological test—they were about half filled with sand. The contamination penetrated the sand and water became infected. Mr. Brush emphasized the need for high velocity flushing.

MR. L. H. ENSLOW (New York City): Described plans for the A.W.W.A. to revise its recommended main disinfection practices, largely because it has proved impossible to provide sufficiently high velocity in main flushing to be effective.

MR. FULMER, continuing discussion of out-of-the-ordinary experiences, described the discovery at Easton that approximately 50 per cent of distributors in the Wheeler type filter bottoms were clogged. This was caused by operation of the backwash at too high a rate. The situation was corrected by increasing the diameter of large stone used (old stone was regraded, not to save costs—it didn't—but because quality of stone was better than new), and by using a lower rate of wash (the old rate was 1.5 times that now employed).

Varied Problems in Water Works Operation

Vance F. Rigling was chairman at the final technical session of the meeting.

The Same Differences

"PRIVATELY OWNED AND AUTHORITY-MANAGED WATER SYSTEMS" were compared in a discussion presented by John H. Long, Manager, Gettysburg Municipal Authority.

There are more points of similarity than there are differences; as the same service and the same insurance, for example, must be provided by each type of operation. Authorities frequently have been extended to include sewage system operations. It appears that the major advances have been inaugurated by privately owned water systems.

Authorities are created by a borough or a municipality (as a separate governmental entity), and are organized for a particular purpose. An authority customarily goes out of existence when the purpose for which it is created is completely served (i.e., need may be based on a 40-year bond issue). Authorities and privately owned utilities are regulated by the same laws concerning the extension of utilities.

Guest Speakers

Water Assn.	S & IW Assn.
H. E. Moses	Ernest Boyce
Consulting Chief Engr.	Prof. of San. Engr.
State Health Dept.	Univ. of Michigan
Harrisburg	Ann Arbor, Mich.

Forests and Water

"WATERSHED FORESTATION" was the topic of a paper by M. K. Goddard, Professor of Forestry, the Pennsylvania State College. The two go together as an interrelated problem of regulating water quantity.

In addition to the value of forestation in preventing silt and sedimentation in water supplies, there is a distinct value in (1) timber, (2) wildlife, and (3) recreation which results. Prof. Goddard showed excellent color slides illustrating the work of a state nursery in raising evergreen trees for reforestation. Watershed lands should be planted so as to leave frequent openings in order to limit the rate of transpiration.

Problems of a Small System

"PROBLEMS IN SMALL WATER SYSTEMS AND THEIR SOLUTION" were reported in a paper by John A. Dietrick, Treasurer, Northern Cambria Water Co.

The operation of the system described is handled by one man: water demand averages 200,000 gpd, and the chlorine used for disinfection is less than 1.0 lb. per day. Characteristic of such small systems, said Mr. Dietrick, is an inadequate income (basically these systems usually are installed and operated for the supply of water to a coal or lumber company. An essential tool for good overall operation is budgetary control.

The "working manager" of a small system must possess a minimum knowledge of mathematics and of hydraulics, and be able to make minor mechanical repairs. He must have ability to explain workings of the system to the public. Keeping books is important and is materially aided by

PRIZES awarded. Left, door prizes "outdoors." Center, golf prizes. Right, Harry Krum receives an umbrella!

Photos by V. M. Langworthy

DAIRY wastes pilot plant. Left, aeration tank. Center, Prof. Kountz explains treatment. Right, sludge (bacterial cells) on filter.

new methods and machines. Above all, the manager must develop independence.

Problems such as those of taste and odor control need technically trained men for solving. The small plant must use the services of state health department sanitary engineers and of chemists from larger water systems. Manufacturers service men and sales engineers are also of real help.

Among details which aid in reducing labor are the use of copper tubing with flared fittings; the Geophone; and electronic line locators for finding leaks. Close cooperation between management and operators is especially important in small water systems.

Sewage and Wastes Assn.

Technical Program*

The technical program of the Pa. Sewage and Industrial Wastes Assn. began with a Sewage Works Symposium presided over by the association's President, Roy F. Weston, Sanitary Engr., The Atantic Refining Co., Philadelphia, Pa. The symposium opened with a paper titled "STANDARD TRICKLING FILTERS" presented by F. W. Jones, Partner, Havens and Emerson, Cleveland, Ohio.

Mr. Jones briefly reviewed the history of trickling filters in the U.S. beginning with the first installation at Reading, Pa. in 1908. Trickling filter design has evolved into a unit including an underdrain, 3 to 10 feet of durable, uniformly sized filter media, and a distributor which applies sewage over the entire filter area. Mr. Jones pointed out that filter flooding for fly control is not as important now as it was twenty years ago.

Effluent from trickling filters must be clarified and the sedimentation units for this purpose must be considered part of the filter. It was emphasized that recirculation of trickling filter effluent is not new and is therefore not necessarily restricted to high rate systems.

Trickling filters, properly operated, may be compared to digestion tanks. Toxic materials interfere with operation, thus control over discharges to the sewer system contributes to good operation. Trickling filter plant effluent should be clear, have no odor, contain 20 to 30 per cent suspended

Award Winners

Glace Award
Reginald B. Adams
Superintendent
Wilkinsburg

President's Cup
F. W. Baker
Manager
Bangor Water Co.

solids, exhibit a 20 to 25 ppm 5 day B.O.D., and contain 4 to 6 ppm dissolved oxygen. Overall purification efficiency should be greater than 85 per cent.

High Rate Filters

The sewage works symposium continued with a discussion of "HIGH RATE FILTERS" by H. B. Gerber, Sanitary Engineer, Garrett, Fleming, Corddray and Carpenter, Inc., Harrisburg, Pa.

These filters are loaded with 10 to 30 mgad, or 1000 pounds of B.O.D. per acre foot. Most high rate filters include provisions for recirculating filter effluent. They are appropriate for treating strong wastes. Slides were presented to illustrate typical installations, particularly the use of a roughing filter to assist in reduction of organic loads and to improve overall plant efficiency.

Photo by Ringer

NIGHT course. Faces of Messers. Coleman, Sigworth, Emerson and Glace show concentration.

Pharmaceutical Wastes

"HIGH RATE FILTERS TREAT MIXED WASTES AT SHARP AND DOHME," by J. A. Liontas, Waste Control Engineer, Sharp and Dohme Co., West Point, Pa., revealed the use of high rate filters handling a pharmaceutical plant effluent.

Slides were used to illustrate plant layout, which is engineered to handle domestic and mixed industrial wastes. Wastes included are those from fermentation and synthetic chemical processes, blood plasma processing, and boiler plant operation.

An example of how waste treatment is considered an integral part of process control at Sharp and Dohme was reported by Mr. Liontas. In this instance, treatment plant personnel are notified when terramycin is to be released from processing so that the waste can be treated with caustic. B.O.D. reductions of 98 per cent and nitrification from 2.4 ppm to 0.5 ppm nitrate nitrogen were reported.

MR. G. A. ELIAS, District Engineer, Pa. State Dept. of Health, Philadelphia, Pa., presented a discussion of the symposium papers. Referring to the cost of standard filters, he indicated disagreement with Mr. Jones in saying that standard filter cost about the same as either types of secondary treatment units, when all factors are included.

In his experience, the presence of detergents does not seem to interfere with the operation of trickling filter plants.

J. N. HAGERICH, Supt., Sewage Treatment Plant, Grove City, Pa.,

*This session reported by V. M. Langworthy, Research Chemist, The Chlorine Institute, Inc.

Management Problems

John H. Long
Manager
Municipal Authority
Gettysburg

John A. Dietrick
Treasurer
Northern Cambria
Water Co.

L. S. Duckworth
Superintendent
Filter Plant
Lancaster

Panel on Operation and Treatment

M. E. Flentje
Res. Engr.
Amer. W. W. Co.
New York, N.Y.

J. O. Fulmer
Chemist
Water Works
Easton

E. C. Kohl
Manager
Water Authority
Myerstown

was the final discussor on the sewage works symposium. He described the Grove City plant, a standard rate filter installation designed for a population loading of nine thousand. Reductions in suspended solids of 96.8 per cent and 96.6 per cent B.O.D. removal are common at this plant. Seasonal effluent chlorination is practiced for disinfection.

Philadelphia's Many Problems

"Early Operating Experiences at the Northeast Sewage Treatment Works," was the title of a paper presented by R. A. Hoot, Chief, Sewage Treatment Section, City of Philadelphia, Pa. The Philadelphia plant described by Mr. Hoot is a modified activated sludge sewage treatment plant. Slides illustrated plant layout and the schematic flow diagram.

Sludge digestion had been unsatisfactory for fifteen months, due to incomplete sludge heating equipment. The activated sludge system does not operate satisfactorily at low or high mixed liquor concentrations. Sewage received at the Northeast plant contains 170 ppm total solids and 150 ppm B.O.D., which values are lowered to 15 ppm. total solids and 16 ppm B.O.D. in the plant effluent.

Industrial waste loads in the raw sewage required that 1000 ppm dissolved oxygen be maintained in the aeration tanks. Grit in the raw sewage has been a problem, but plant improvements include the installation of mechanical grit removal equipment. When sludge heating equipment was finally installed, sludge digestion was greatly improved.

"Submerged Sludge Heating at Northeast Sewage Treatment Works," a paper by Samuel S. Baxter, Commissioner, Water Department, Philadelphia, Pa., and H. Horlacher, Mech. Engr., Design Bureau, Water Dept., Philadelphia, Pa. was presented by Mr. Horlacher.

A method was sought for efficient heat transfer in sludge heating, to combat caking, corrosion and plugging. Types of submerged heating units were illustrated. The sewage gas burners are situated above a tank containing sewage sludge. Gases at 2700 degrees F are passed into the sludge as it flows to the digestors, with exhaust gases being vented through the roof of the heater building. By this method, sludge is easily maintained at 95 to 100 degrees F.

Cost of the submerged heating equipment installed at Northeast was given as $86,000, with an additional $6,000 for weirs and inspection ports. The new Southwest plant will employ submerged sludge heating units, with some changes: No outlet piping will be used, heated sludge will flow through a channel to an enclosed sump. Gases will be exhausted to the atmosphere through appropriately placed vents.

Local Arrangements Comm.

R. Y. Sigworth
Water Supt.
State College

B. H. Brock
Mfrs. Representative
State College

Miles Lamb, Chicago Pump Co., Chicago, Ill., discussed the availability of package units for submerged sludge heating. Automatic temperature control is a desirable feature, with overall cost of the units comparing favorably with other types of heaters. Typical units are in use at Columbus, Ind., and Erie, Pa., and are planned for use in several other cities.

Industrial Wastes Symposium

Gordon J. Wiest, Warner Company, Devault, Pa., new Vice-President of the Assn., presided over a symposium on industrial wastes.

"Industrial Wastes Control Progress in Pennsylvania," was the title under which F. B. Milligan, Division Engineer, Pennsylvania Dept. of Health, Harrisburg, Pa., discussed the development of pollution control regulations in Pennsylvania. He pointed out that conservation and pollution control are at present the only methods which will insure plentiful water supplies. Streams in Pennsylvania are grouped according to the degree of treatment required and blanket treatment minimums are established.

Pollution control is a continuing project, with expanding industry and greater use of surface waters necessitating improved treatment. Savings from improved housekeeping are not often realized until waste treatment is actually begun, nor do downstream savings result until wastes are treated upstream. At least two annual health department inspections are required to insure good operation of waste treatment plants, according to Mr. Milligan.

Laboratory research contributes heavily to the advancement of the art of industrial waste handling. Fish toxicity, temperatures and dissolved oxygen depletion are factors which must be known about all plant effluents.

Preventing Industrial Pollution

"Pollution Control by Preventive Measures" was the title of a paper presented by L. L. Hedge-

Bethlehem Project

J. R. Forsyth
Div. Engr.
Morris Knowles, Inc.
Pittsburgh

C. H. Young
Div. Engr.
State Health Dept.
Harrisburg

F. W. Jones
Partner
Havens & Emerson
Cleveland, O.

H. B. Gerber
Fleming, Corrddry, Carpenter
Harrisburg

J. A. Liontas
Waste Control Engr.
Sharp & Dohme
West Point

Trickling Filter Symposium

G. A. Elias
Dist. Engr.
State Health Dept.
Philadelphia

Ralph A. Hoot
Chief
Sewage Treatment
Philadelphia

H. Horlacher
Mech. Engr.
Water Dept.
Philadelphia

Philadelphia Northeast Plant

peth, Technical Consultant, Calco Division, American Cyanamid Co., Bound Brook, N.J.

This paper reviewed the increase of stream pollution resulting from industrial expansion during World War II, and illustrated how essential it is that water conservation be practiced. Industry must do its share to control stream pollution and alleviate the three threats to the public interest: public health, water conservation and recreation.

Poor plant location on the part of industry, with disregard of the assimilation resources of the receiving stream, was emphasized as a major factor involved in industrial pollution. Mr. Hedgepeth concludes that industry is realizing the fallacy of locating a large wet process plant on a small fresh water stream. Government is becoming aware that a small stream which drains a highly industrialized and populated area is not a satisfactory source of potable water or a recreational area.

He further suggests that internal control and treatment of final effluents are equally useful tools in the regulation of industrial pollution. Samples were shown which displayed the possibilities of process changes when technical know-how is applied in the plant. Two highly colored wastes were exhibited, one practically impossible to cope with from a waste treatment standpoint, the other completely compatible with receiving stream conditions, yet both wastes are equally satisfactory from the production standpoint.

A. N. Heller
Barrett Div.
Allied Chem. & Dye
New York, N.Y.

F. M. Majewski
Chem. Engr.
Rohm & Haas Co.
Bristol

Industrial Wastes

Plating Waste Treatment

"PLATING ROOM WASTES" a paper presented by Dr. L. E. Lancy, Electroplating Consultant, Ellwood City, Pa., covered the development of an altered metal finishing sequence wherein droplets of plating solution are removed from materials prior to rinsing. Abatement of pollution is thus accomplished and cyanides are oxidized with chlorine in the plating room proper. Slides illustrated the requirements of a satisfactory rinsing installation and how the chlorine waste treatment plan can be integrated into plating operations with which operators are familiar.

F. B. Milligan
Div. Engr.
State Health Dept.
Harrisburg

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Industrial Wastes

Better Process Control

"PROCESS ENGINEERING—AN APPROACH TO STREAM POLLUTION ABATEMENT" a joint paper by A. N. Heller, Supervisor, and M. E. Wenger, Engineering Group Leader, Industrial Waste Development Section, The Barrett Div., Allied Chemical & Dye Corp., New York, N.Y.

The authors described a unique process control development in synthetic phenol production which reduced waste and improved overall plant operation.

The paper reviewed various processes utilized in producing phenol (it was stated that 75 per cent of the phenol produced in the United States is synthetic). The necessity of preventing phenol contamination of surface waters is a problem of importance, complicated by the fact that each process produces different pollutants. The specific process developed by Barrett Division process engineers altered the production flow sheet to include a phenol-boil out process which eliminated wastes containing phenols or phenolic compounds. It was estimated that $100,000 was the amount required to cover all costs incident to the process change.

Treating Paper Mill Wastes

"PAPER MILL WASTES" was the title of the concluding paper in the industrial wastes symposium. Presented by H. T. Reuning, Supervising Wastes Engineer, New York and Pennsylvania Co. Inc., Johnsonburg, Pa., the paper discussed evaporation and save-all methods of waste treatment. In-plant studies are necessary to reduce and control waste flow. These studies are best performed by a separate paper mill department which reports directly to the main office. Waste surveys and routine checks insure maintenance of reduced waste volumes.

Chlorine Treatment Method

"THE TREATMENT OF WASTES CONTAINING DICHLOROPHENOL" was the title of a paper by Mr. F. M. Majewski, Chemical Engineer, Rohm and Haas Co., Bristol, Pa. Phenol bearing wastes are common in industry, existing as alkylated phenols, cresols and other compounds.

Solvent extraction procedures may be used economically if a waste contains more than 100 ppm phenol and is low in volume. Biological treatment (trickling filters) may be used on large volumes having low phenol concentrations. Where the concentration and volume are such that solvent extraction or trickling filter methods are

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Gravity Separation of Wastes

R. D. Nickerson
Eastern Sales Mgr.
Combustion Eng.
New York, N.Y.

T. F. Reed
Research Assoc.
U.S. Steel Corp.
Pittsburgh

Sludge Disposal Panel

S. X. Bessen
San. Engr.
Komline-Sanderson
Peapack, N.J.

not applicable, other treatment may be used and savings in capital investment may be realized.

Such an alternative method was described by the author in an installation where research indicated that chlorine might be specific for wastes containing between 100 and 3000 ppm dichlorophenol. Variables which exist are pH, which ranges from pH 1 to pH 9, and temperatures from 30 to 60 degrees C. Investigation revealed that either hypochlorites or gaseous chlorine may be used to lower the dichlorophenol to less than 1.0 ppm. The reaction was found to proceed most favorably at pH 6 and 50 degrees C when at least 15 minutes contact time was provided. No great change occurred within two hours, after the initial fifteen minutes had elapsed.

Bethlehem's New Plant

Incoming president T. R. Haseltine, Partner, The Chester Engineers, Pittsburgh, Pa., presided at the final technical session of the conference.

J. R. Forsyth described the Bethlehem, Pa. sewage treatment project, from floating revenue bonds through design details of the new 12.5 MGD trickling filter plant.

In discussing Mr. Forsyth's paper, C. H. Young, Division Engineer, Pa. Dept. of Health, Harrisburg, Pa., revealed that the Bethlehem project is the largest sewage plant and intercepting sewer system thus far constructed under an authority in Pennsylvania, and financed by Sewer Revenue Bonds. The plant will receive sanitary sewage from nearby Bethlehem Steel Works where a complete sanitary sewage collection system was constructed.

Gravity Separation of Solids

"Operating Experience in Sedimentation of Rolling Mill Wastes," by G. A. Pettit, Industrial Wastes Control Engineer, Armco Steel Corp., Middletown, Ohio.

The steps in rolling an ingot into a finished strip of steel involve the use of water sprays which remove scale formed during the rolling process. Sedimentation of this iron oxide and of the oils and greases present a problem more difficult than formerly believed.

Scale particles vary widely in size and shape; they plug sewers, so that open channels and high velocity water sprays are needed to keep the scale moving. Slides illustrated details of the settling basin and sludge collecting mechanism, which does not function as a grease removal device on flight return. Mr. Pettit stated that 139,000 pounds of suspended solids per day are removed and reclaimed in the blast furnace. Present plans are to reuse the water effluent in the rolling mill proper.

"Silt," a discussion by C. L. Siebert, Jr., Chief, Silt Control Section, Pa. Dept. of Health, Harrisburg, Pa., revealed sources of silt to be coal, sand and stone washed and from ashes, as well as other mining and metallurgical processes. Natural clay is difficult to remove from a waste water, but it must be removed to prevent shoaling of stream beds, thus distorting stream channels. Particles which are too fine to settle degrade the stream water for other uses, placing a burden on downstream users.

Methods of silt removal are settling basins, or ponds, which are simple to operate and require low investment. Settling tanks and hydro clarifiers are rapid and efficient, but are costly. The problem with either method of silt removal is sludge disposal. The pond or settling tank effluent may be recirculated if necessary.

Mr. Siebert mentioned that the cyclone thickener looked promising as a silt removing device, it is being successfully used on bituminous coal wastes. The thickener removes fines, and the sludge can be dewatered on screens or vacuum filters.

"Oil," a paper by H. F. Elkin, Assist. Project Engineer, Sun Oil Co., Philadelphia, Pa., reviewed the history of the American Petroleum Institute in developing oil water separation units from 1930 to date. Slides illustrated flow diagrams of progressive changes in separator design.

The present edition (1953) of the API Manual includes smaller oil globule separation, with an increased horizontal velocity. A clearer definition of terms has been arrived at in the new volume.

Panel on Sludge Disposal

A Floor and Panel Discussion led by President Haseltine, considered domestic and industrial sludge disposal. Members of the panel were R. D. Nickerson, Eastern Sales Mgr., Raymond-Flash Division, Combustion Engineering, Inc., New York, N.Y.; J. P. McDonald, Supt., Sewage Treatment Works, Lancaster, Pa.; T. F. Reed, Research Associate, U.S. Steel Corp., Pittsburgh, Pa.; S. X. Bessen, San. Engr., Komline-Sanderson, Engineering Corp., Peapack, N.J.; and R. R. Kountz, Professor of Sanitary Engineering, The Pennsylvania State College, State College, Pa.

Predominately discussed was the problem of sludge disposal after vacuum filtration, or drying in some other way as on sand beds or from drained lagoons. This is not an easily solved problem, particularly in areas where property values prohibit dumping.

"Sewage Treatment at Altoona, Pa." was the title of a paper presented by L. L. Gwin, City Engineer, Altoona, Pa., as the prelude to an inspection of Mr. Gwin's two activated sludge plants serving Altoona. Original sewage treatment facilities were constructed in 1890 and renovated in 1937. Present treatment plants are the Easterly plant, which discharges its effluent to the East Branch of the Juniata River, and the Westerly plant, the effluent from which flows into the Frankstown Branch of the Juniata River.

WATER WORKS PRACTICES

OPERATION • MAINTENANCE • MANAGEMENT

Source of Supply

Part 2, Ground Water

The Sixth of a Series

by GEORGE E. SYMONS, Ph.D., Consultant & Technical Editor, Larchmont, N.Y.

AS stated in the previous lecture, the discussion of water supply sources is fundamentally a continuation of the subject of the Hydrologic Cycle. That lecture—"Source of Supply—Part 1, Surface Water", contained general information and data pertinent to both surface and ground waters and will not be repeated here except briefly.

Ground water is used by 4446 cities as a municipal supply for 21,500,000 persons, compared to 2120 municipal surface supplies for 51,000,000 persons. Inasmuch as most rural habitations and many homes in unincorporated communities use ground water (usually shallow wells), it appears quite probable that more persons drink ground water than surface water.

This article is one of a series on the general subject of "Water Works Practices," developed by Dr. Symons in the simple style of a short course lecture and designed to be of interest to small plant operators, new operators, students and any others who may wish to review the fundamentals of the subject.—*The Editors*

A . . . Occurence

1. PERCOLATION

a. Approximately half of the total rainfall percolates, infiltrates or seeps into the ground. It is drawn from the ground for use, or is transpired by vegetation, or works its way into porous formations.

b. Superficial ground water is that held and absorbed by humified soil and is known as *field moisture.*

FIELD MOISTURE CAPACITY
per 100 lbs. of material

Type of Soil	*Lbs. of Water*
Sand	25
Clay	50
Humus	200

c. About four-fifths of the water entering the ground (i.e., 40 per cent of the rainfall) leaves the ground by transpiration through plants. Therefore only 8 to 10 per cent of the total rainfall percolates downward under the influence of gravity until it reaches an impervious stratum.

d. When percolating water reaches an impervious stratum, it begins a lateral movement in a *zone of saturation.* This water-bearing stratum above the impervious stratum is called an *aquifer* and the water in this aquifer is known as *ground water.* (See sketches).

2. WATER-BEARING FORMATIONS

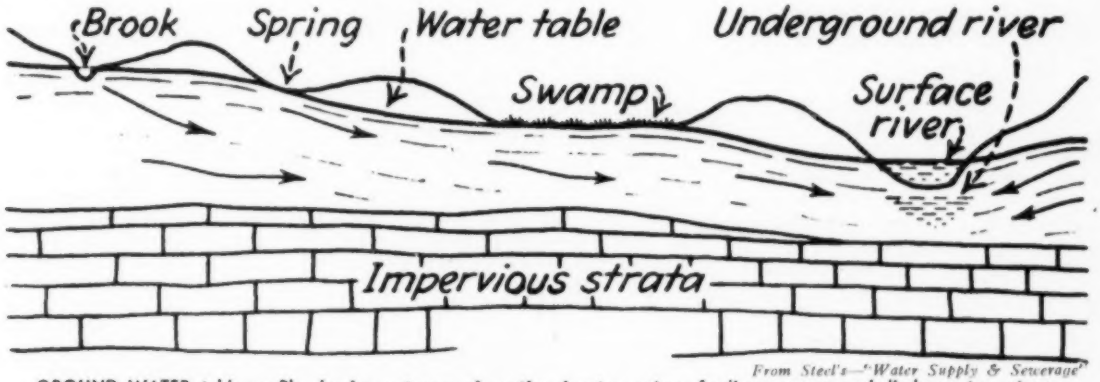
a. Ground water aquifers occur principally in:

(1) Sedimentary porous materials.
(2) Buried river valleys or beds of ancient lakes.
(3) Glacial deposits in northern states.
(4) Free flowing underground streams, as caverns in limestone districts.

b. Sands, gravels and sandstones furnish most of the ground water supplies in the U.S. The main underground water basins in the U.S. are:

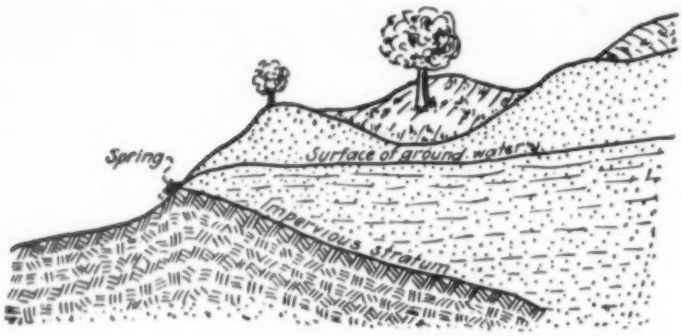
St. Peter Sandstone—Minnesota, Iowa, Illinois, Missouri
Dakota Sandstone—The Dakotas and Nebraska
Marshall Sandstone—Southern Michigan
Atlantic Coastal Basin—New Jersey to Florida
Gulf of Mexico Coastal Basin
Southern California Basin
San Joaquin Basin—Central California
Boswell Basin—New Mexico

c. *Porosity* (volume of pores, voids or open spaces in a substance) is the principal factor in the amount of



From Steel's—"Water Supply & Sewerage"

GROUND WATER table profile showing outcrops of aquifer, forming springs, feeding a swamp and discharge to a stream.



From Babbitt & Doland's "Water Supply Engineering"

WATER TABLE, with aquifer outcropping as a series of springs along top of impervious strata forming a dam to underground reservoir.

water a stratum can hold. Porosity is expressed in per cent of total volume:

Type of Substance	*% Porosity*
Igneous Rock	1
Shale	4
Limestone	0.5 to 17
Sandstones	13 to 30
Sand or Gravel	30 to 40
Clays	44 to 47
Top Soil	37 to 65

d. *Perviousness* is the capacity of a substance to allow water to pass through it and therefore is a measure of the availability of water for use.

e. *Permeability and Transmissibility* are measures of the ease with which water will flow through a porous medium. Permeability measures the horizontal rate of flow in gallons per day through a square foot of stratum. Transmissibility measures the vertical rate of flow in gallons per sq. ft. per day through the depth of the aquifer.

f. The surface of the ground water layer or aquifer is called the *water table*. An exception is where the aquifer is below an impervious layer and under pressure.

The water table is not constant, but fluctuates with rainfall, temperature, barometric pressure, rate of pumping, etc.

Ground water will either feed streams or be fed by them, depending on the level of the particular stream with respect to the water table.

3. Underground Flow

a. Ground water moves at a slow pace always down grade toward the sea; it may come to the surface or discharge into a lake or river or the ocean; or it may be blocked in underground storage. (See sketch).

b. The slope of a ground water table is called the *hydraulic gradient* and in the shallower ground waters roughly follows the topography of the ground surface; always toward, but never below, the surface of the stream, lake, etc. into which the aquifer discharges. (See sketch).

c. Velocity of movement of ground water in coarse material with a sharp hydraulic gradient may be 20 ft. per *day;* in sandstones of fine texture the velocity may be as low as 10 ft. per *year.*

Velocity of flow may be measured by determining the time of travel of a dye from one test hole to another or by addition of an electrolyte, the travel time of which is determined from conductivity tests at two test holes.

d. Velocity of underground flow is not the sole criterion of the amount of water which can be obtained in a period of time (permeability and transmissibility are factors). However, the velocity of flow, hence quantity, is the criterion of the ultimate or long-time yield, for no more water can be taken from an aquifer than enters it.

B . . . Quality

1. Solvent Action

a. During passage through the ground, water comes into contact with both organic and inorganic matter, and dissolves some of these substances.

b. Carbon dioxide from the air or from decaying vegetation aids in the dissolving of alkaline and mineral substances, particularly carbonates of calcium and magnesium which contribute alkalinity and hardness to the water.

c. Sulfates of calcium and magnesium are also dissolved, contributing non-carbonate hardness.

d. Decomposition of organic matter in soil removes oxygen from water percolating through it and such water with carbon dioxide present will dissolve iron and manganese, both of which are undesirable in water supplies.

2. Pollution

a. Bacteria are usually filtered out as water percolates into the sub-soil, unless fissured or creviced rocks, such as limestone, occur near the surface, in which case pollution may be carried great distances.

b. Sanitary conditions in the vicinity of the ground water source are important, particularly in shallow well supplies.

Pollution introduced below the ground, especially if below the water table, is dangerous. Industrial waste pollution of this type has been a problem in some areas.

3. Characteristics

a. Ground waters are generally clear, cold, colorless and are harder than surface supplies in the same area.

b. In limestone areas, ground waters are very hard and non-corrosive; in granite areas ground waters are soft, high in carbon dioxide and quite corrosive.

c. Bacterial content of ground waters is extremely low or absent except as noted above.

d. Temperature of ground water depends upon the depth of the aquifer.

(1) Within 10 ft of the surface the water shows a wide temperature range during the year.

(2) At depths of 30 to 60 ft the water temperature is usually constant throughout the year and is generally a few degrees Fahrenheit above the annual average air temperature for the region.

(3) In deep wells, because of the heat of the earth, the water temperature is higher than that of shallow or moderately deep wells.

(4) Temperatures will increase 1°F. for each 65 ft (approximately) of depth, but this factor depends on geology.

e. Except where hardness (or iron and manganese) is a problem, ground waters generally are better than surface supplies because their characteristics are quite constant and such waters require less treatment than surface supplies.

C . . . Types of Underground Supplies

1. Springs

a. Ground water reappears at the surface in three different types of springs:

(1) Where there is overflow of the ground water table.

(2) Where percolating water encounters an outcropping impervious layer, this being the most common type of spring—(See sketch).

(3) Where percolating water is found under pressure beneath an impervious stratum; this is known as an artesian spring or flowing well—(See sketch).

b. For type one springs the most water with the most certainty of continuous yield is obtained by constructing a cut-off trench along a contour

or near the point of appearance of the spring.

c. Type two springs have relatively small underground storage. For the most yield a cut-off trench offers the best construction.

d. Type three, or artesian springs, have large tributory watersheds at some distance from the spring, which is under pressure. They are classified by O. E. Meinzer according to "order of magnitude" based on flow.

Order of Magnitude	*Flow*
1	100 cfs
2	10 to 100 cfs
3	1 to 10 "
4	100 to 448 gpm
5	10 to 100 "
6	1 to 10 "
7	⅛ to 1 "

e. Reverse springs occur where a surface stream disappears to flow underground, usually in limestone, sandy or gravelly areas.

f. Spring waters from shallow strata are more likely to be affected by surface pollution than are deeper aquifers.

g. Few public supplies have been developed from springs because there are few springs large enough to afford ample supplies.

2. Shallow Wells

a. The term shallow well is usually reserved for wells less than 50 ft. deep.

b. Vertical or approximately vertical holes from the surface of the earth penetrating an aquifer in which the surface of the water outside of and surrounding the well is at atmospheric pressure is called a *gravity well.*

c. Shallow wells may be dug of large diameter or may be small diameter tubular wells, known as driven wells.

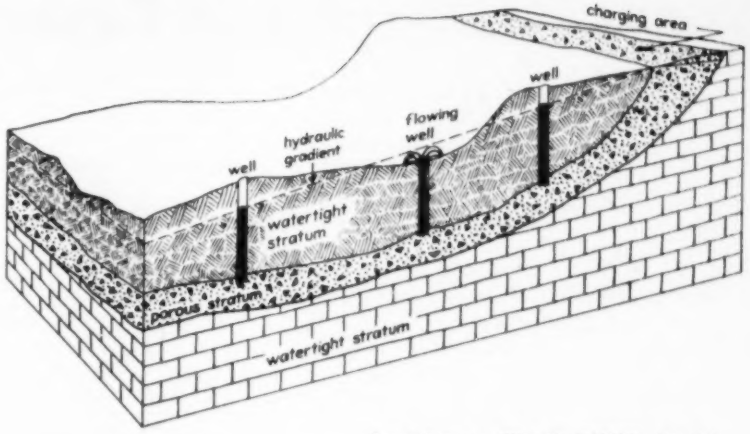
d. Quality of water from shallow wells is largely determined by the character of the nearby catchment areas.

3. Infiltration Galleries

a. Like shallow wells infiltration galleries are developed in shallow water bearing strata adjacent to streams, lakes or ponds.

b. Characteristics of water from infiltration galleries is approximately the same as that in the adjacent stream, lake or pond (except that its turbidity, color and bacterial content are usually better).

c. Yield of infiltration galleries and well fields can sometimes be increased by flooding pervious areas in the vicinity. This is known as ground water recharge and is becoming increasingly practiced.



From "Report on Water"—POWER, Sept. '52

ARTESIAN WELL model, depicting deep aquifer under pressure beneath impervious strata.

Note hydraulic gradient line passes above surface level at one point, which results in the center artesian well becoming a flowing well.

4. Deep Wells

a. Deep wells are driven or drilled to depths of greater than 50 ft to a water bearing stratum which may lie below one or more impervious strata.

b. An *artesian well* is one in which the level of the water in the well rises above the level of the aquifer. In short, the water in the aquifer is under pressure at the point of well location—(see sketch).

c. If the water in an artesian well rises above the ground surface, it is known as a *flowing well.* Contrary to the understanding of many, an artesian well is not necessarily a flowing well—(See sketch showing three artesian wells, only one of which is a flowing well).

d. The catchment area for deep wells is usually many miles distant from the well and is generally quite extensive.

e. Water in deep wells is likely to be more highly mineralized than shallow wells and may contain iron and manganese and in some cases carbon dioxide, methane gas or hydrogen sulphide. The water is usually cold, clear and free from bacteria.

5. Ranney Wells

a. Either shallow or deep, the Ranney type well (sometimes referred to as a "water-mine" consists of a large central cylinder sunk to the aquifer, with tubes radiating horizontally, like spokes, from this central chamber out into the zone of saturation. This type of well, believed to have been first used for a community water supply by the late Daniel Mead in the late 1890's at Rockford, Ill., provides increased flow capacity within an aquifer. Where ground water conditions are favorable to the use of this type of well it is quite successful.

D . . . Selection of Source of Supply

1. Water Policy

a. In approaching the problem of deciding upon a new source of water supply, or of augmenting a present supply, sound thinking and the application of engineering principles are essential.

2. Water Survey

a. Both for an industry and a municipality the first step in applying sound engineering principles is to make a water survey.

b. A detailed water survey will include a thorough appraisal of all possible sources of supply and the various factors outlined in this and the previous lecture on "Sources of Supply—Surface and Ground"

c. If a surface supply is to be used, the next step is to consider storage, that is reservoir construction, maintenance and operation.

d. If a ground water supply is to be used, the aquifer compresses the supply reservoir. The next step to consider is the location, construction, maintenance and operation of wells so as to make the fullest use of the underground storage and natural recharge of the aquifer.

E . . . Reference Material

More detailed discussions of the various topics presented in this lecture are to be found in the same texts listed in the previous lecture on "Surface Supplies" and in "Water Supply Paper No. 557" (1927) of the U.S. Geological Survey, by O. E. Meinzer of the Survey.

Next Lecture

Reservoirs: Construction, Maintenance and Operation.

About Research and Experimentation

An Open Letter from One Water Works Man to Another

Dear "Bill"—

I suppose you've read in the papers lately that the Federal Government, through the Reclamation Bureau, has awarded eleven contracts entailing about $1,000,000 for research directed to the development of a practical method of desalting sea water. When the government gets into a project it's always big and, of course, the possibility of obtaining a plentiful supply of fresh water from the sea sounds very alluring and would offer a big dividend to the country if it can be done. It offers a big problem to the researchers, too, and maybe the government is the one to finance these studies. Well, I didn't start this letter to raise the question as to how the government should spend our money. What I really had on my mind is research and what we water works men might do to study and improve this business of supplying the best possible water to thirsty communities.

I got to thinking about what I heard a fellow say on the subject of research, at a breakfast session of the N. Y. Section of AWWA, in Elmira, N. Y. last spring. According to this fellow, "Research is the application of controlled scientific investigation to solve a problem, to develop a new or improved device or operation, or to find a better way of doing something." In its higher meaning, "Research is an effort to learn a basic truth or seek the answer to the mystery of nature."

This N. Y. Section speaker went on to quote from an article in *Industrial & Engineering Chemistry*, to the effect that there are three phases of technical research: (1) Exploratory, or the search for new fields or new goals. (2) Data gathering and manipulation, in an effort to reveal the fundamental facts of nature, and (3) Design and development, or the application of ideas gained in phase two, to practical purposes.

Practical Small Scale Research

Well, of course, that all sounds pretty important but how does that fit in with any plans on a small scale that you and I might have about doing some investigative work. Well, this chap who was talking at Elmira had some ideas on that, too.

"First," he said "we're interested in practical research, not theoretical investigations, and such research can be carried on in the plant, in the field, in the laboratory or even in the office." Much research is an effort to obtain the answer to the question, "Why do this?"; in fact theoretical research seeks the answer to the question "why," while practical research is more apt to determine the answer to the questions "where" and "how."

Secondly, according to the speaker, if we're interested in research, we should set a goal, which can be determined from a study of needs or the desire to improve existing operations. Having established a goal, the next question is, "How to achieve it?" One way is to look over someone else's shoulder. You know how you can always tell a card player his mistakes by kibitzing; well, do the same in research, kibitz on previous workers by reading their reports and articles and then start from there.

Another thing, do a lot of thinking, consciously and subconsciously, before you start. "A good researcher does a thousand experiments in his mind before he does one in his laboratory." Follow the precept of Edison, "Observe, remember and compare." Observations on one situation may be the key to another.

Of course, if you really expect to learn the answers to how, what, where or why, you have to be prepared to spend a long time in slow and painstaking observations. That's especially true in laboratory or engineering research. "Furthermore," according to the Elmira speaker, "although research has been proven to pay off, it may be only one idea in ten that is successful." I remember seeing a story in *Life Magazine* about DuPont research, and one photograph showed three piles of reports on projects: Seven had been successful, 51 unsuccessful and 67 were still under investigation.

Unfortunately, in the water works industry, most of the research is carried on by equipment manufacturers, universities, and large municipal utilities. This is fine, but more work of an experimental nature should be done in smaller water plants, like yours and mine.

Current Problems Needing Study

What are some of the current problems receiving or needing study, you say? Well now, there's work being done on microstrainers for filtration, microfilters for bacteriological testing, plastic pipe, sulfur joint compounds, water hammer, the mechanism of corrosion and the role of inhibitors, atom wastes and the desalting of sea water. The chap who spoke at the N. Y. Sect. meeting suggested that we need: Improved chemical tests for fluorides and residual chlorine; more knowledge on detergents, poliomyelitis and taste and odor control; better information on the cause of dysentery in water supplies; disposal methods for filter wash waters and softening sludge; and more knowledge, too, on unaccounted for water, and public relations.

I'd like to add other needs: a demand meter for air conditioning and industrial customers; easier methods for laying pipe; establishment of our rights to lay mains in streets and highways, improved water quality standards, quick methods for bacteriological testing and yes, even divining rods for locating both water and pipes.

I don't know whether or not there are any ideas in these that you will ever tackle,—you probably have some ideas of your own—but I think you and I and a lot of other water works men owe ourselves and posterity the effort to solve some current problems. I for one am going to begin on one of my worst headaches, flat rates and unaccounted for water. Hope I see you at the next AWWA meeting and let's explore this idea of more research and experimentation seriously.

Yours,

"Ed."

P.S.—I understand that down in Texas they have discovered that tastes and odors in natural pond and lake waters can be traced to other biological growths than algae. These organisms get by sand filters and seed the mains. Watching algae counts in raw water reservoirs may not be the answer to our taste and odor problems. They are working on this problem and studying ways to combat the growth of and tastes caused by these minute organisms. I'd like to be in on that study, because I have long felt that we haven't *really* solved our taste and odor problems yet. Corrosion and tastes and odors still remain as incompletely solved problems in our business and, I believe, are the most important problems we still have in our endeavor to deliver the best possible product to our customers.

Fig. 1—CONCRETE BOX CONDUIT carries water, sewer, steam and condensate lines.

Protecting Underground Utilities Located in Arctic Regions

by **CARL HENRY BILLINGS, C.E.,** ***Water and Sewer Design Unit, Alaska District, U.S. Army Corps of Engineers***

BEFORE the design of any properly engineered work can proceed, certain conditions to be encountered during construction or within the lifetime of the finished product must be known. Such basic logic is very apparent in results gained through experiences with underground operations in the sizable Alaska defense construction program under supervision of the Corps of Engineers.

Once the conditions are known, they often dictate the use of certain specialized design and construction procedures to produce a sound and lasting work. The phenomena peculiar to the arctic call for a far different approach to the design of utilities than do the conditions encountered in temperate climates.

Conditions Encountered in Arctic Regions

The four sections of Alaska are divided into three climatic parts. The Southeastern Coast and the Aleutian Chain have temperate climates. The main body of Alaska south of the Alaskan Range is classified as sub-arctic; the area north of the range is arctic. In the northern part, temperatures range from —70° to +90° F. Winds as high as 90 mph sweep across lands which are barren or covered only by scrub growth. Precipitation throughout the arctic is relatively slight. Hence, snow cover, except where drifts gather, is generally shallow. All these factors combine to produce very deep seasonal frosts. At Big Delta, just south of Fairbanks where no permafrost is in evidence, seasonal frosts have been reported to be in excess of twelve feet deep.

Permafrost Characteristics

Nearly all of Arctic Alaska is underlain by permanently frozen ground, or "permafrost" as it is commonly called. It is found in nearly one-half of the territory of the U.S.S.R. and a great part of Northern Canada. All together, permafrost occurs under about one-fifth of the world's land area.

The thickness of permafrost varies from a few feet in the south to several hundred feet in the north. A depth of frost of about 1300 feet is reported from Amderma on the arctic coast of Russia.

Permanently frozen ground or permafrost is defined as ground that has remained below 32° F for a long time; that is, through several thawing seasons. It need not necessarily be soil. Frozen bedrock is considered permafrost. Moisture is not a necessity either; frozen ground without moisture being known as "dry permafrost." However, it must be pointed out that the engineer in Alaska will seldom be fortunate enough to deal with either frozen bedrock or dry permafrost.

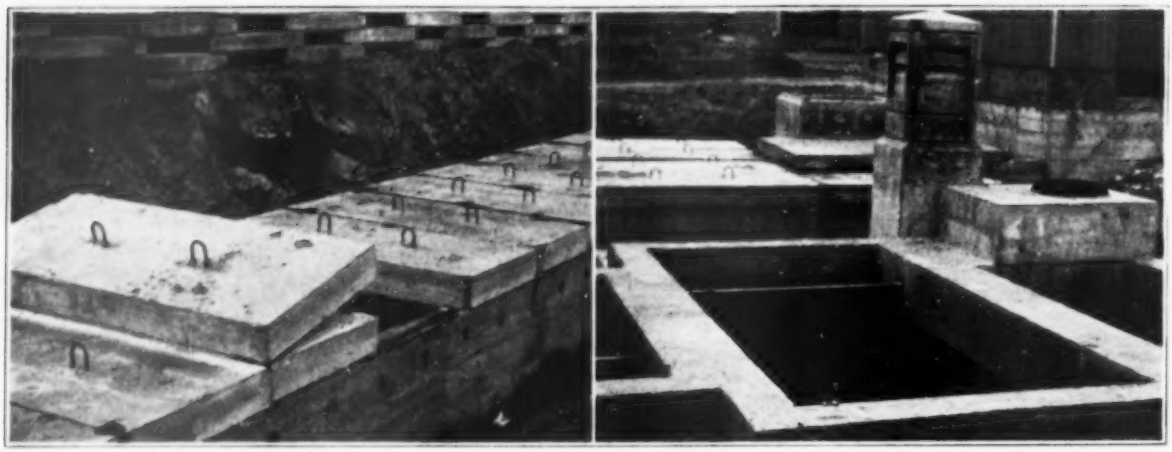


Fig. 2—(Left) PRECAST removable covers provide easy access for replacing pipe. (Right) CLOSE view of manhole and ventilator shaft.

Heat Entering the Ground

To understand the mechanics of permafrost let us examine the heat flow into and out of the ground during the thawing and freezing seasons. If it is assumed that the temperature of the soil below the seasonal freeze is 32° F., that the temperature gradients in hemogenous ground in the layer in question are approximately straight lines (an assumption justified by ground temperature readings), and that the depth of frozen ground at the end of the freezing season is equal to the depth of ground thawed at the end of the thawing season; then, the approximate amount of heat which enters the ground during the thawing season per square foot of level ground is:

$$Q_u = \frac{k_u G_u t_u (24)}{x/2} = \frac{48\ k_u I}{x}$$

in which:

Q_u = total amount of heat which enters the ground during the period the ground thaws.

k_u = thermal conductivity of the thawed soil.

G_u = average surface temperature in °F during the thawing season minus 32.

t_u = number of days the surface temperature is above 32° F.

x = maximum depth of thaw in feet.

$x/2$ = average depth of thaw during season.

24 = number of hours in a day.

$I = G_u t_u$ = thawing index or number of degree days of thew.

Heat Leaving the Ground

Similarly the equation for heat flow out of the ground during the freezing season may be expressed as:

$$Q_f = \frac{k_f G_f t_f (24)}{x/2} = \frac{48\ k_f F}{x}$$

Q_f = the total amount of heat which flows out of the ground during the freezing season.

k_f = thermal conductivity of frozen soil.

G_f = 32 minus the average surface temperature during the freezing season.

t_f = number of days the surface temperature is below 32° F.

$F = G_f t_f$ = freezing index or number of degree days of freeze.

Since the heat necessary to thaw layer "x" is equal to the heat given up in freezing it (any other heat involved being neglected as minor), these equations can be combined to give:

$$k_u I = k_f F$$

Under the assumptions upon which these equations are based, seasonal thaw is equal to seasonal freeze and no permafrost exists.

In order for permafrost to exist, the seasonal thaw cannot melt all of the frozen ground, therefore:

$$k_f F > k_u I$$

$$\frac{k_f}{k_u} > \frac{I}{F}$$

Thermal Conductivity Values

One of the factors which greatly influences the formation of permafrost is the difference of thermal conductivities of water and ice. The thermal conductivity of ice is approximately 16 BTU per square foot per hour per °F per inch thickness, and that of water, 4 BTU per square foot per hour per °F per inch thickness, making a ratio of 4 to 1. Thus the conductivity of a frozen soil is a function of its moisture content, and under most conditions the greater the moisture content the greater is the ratio of the thermal conductivity of the soil frozen to that of the soil thawed.

For Fairbanks, silt loam conduc-

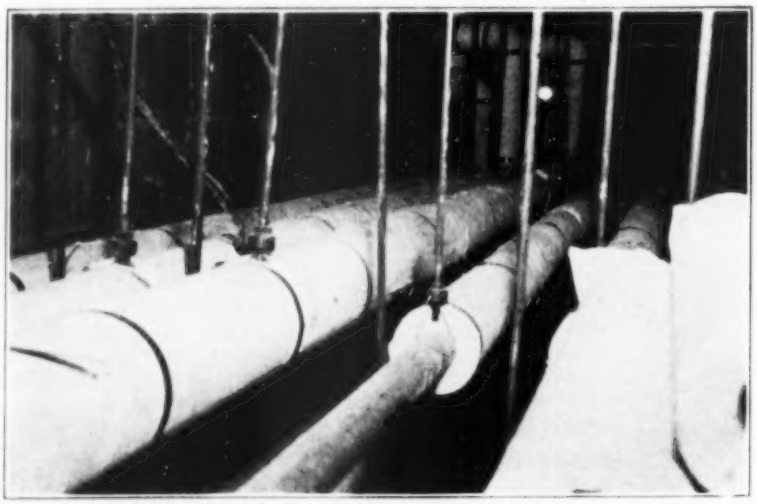


Fig. 3—INTERIOR of box type utilidor showing insulated water and steam lines. Insulation prevents heat loss from steam system and heat gain in water system.

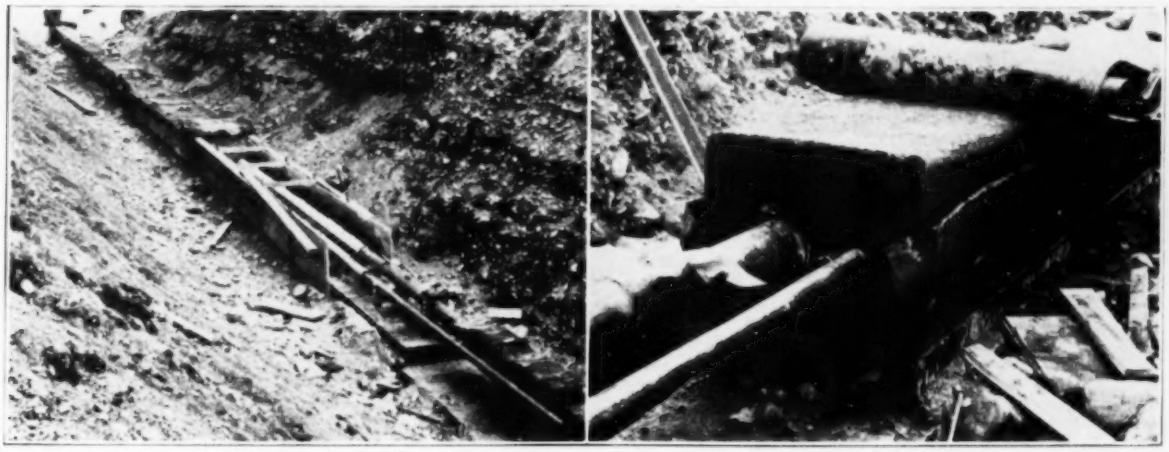


Fig. 4—INSULATING concrete conduit. (Left) Base is Portland cement. (Right) Section around pipes is expanded vermiculite concrete.

tivity values determined by experiment are in Table I.

Table I
CONDUCTIVITY VALUES

Dry Density lb. per cu. ft.	Moisture Content %	Mean Temperature °F	Thermal Conductivity BTU/sq. ft./hr./° F/in.
93.3	24.4	40.0	9.55
93.3	24.2	24.9	13.23

From this it may be seen that:

$$\frac{k_f = 13.23}{k_u = 9.55} = 1.39$$

That is, I/F must be less than 1.39 for permafrost to exist. Notice that this ratio can be greater than 1.00. Even though the thawing index is greater than the freezing index, permafrost may be in evidence.

At the end of the freezing season, the seasonal frost layer—or active layer as it is called in permafrost regions—generally is completely frozen down to the upper level of the permafrost and is being cooled below 32° F at that level. To maintain a constant level of permanently frozen ground it is only necessary to freeze back during the freezing season that which was melted during the thawing season. However, if the mean annual temperature should raise appreciably, the temperature gradient in the permafrost would be so disarranged as to cause melting upward from the bottom.

Permafrost Facts in Brief

The arctic engineer should keep in mind these facts about permafrost:

1. Its formation and continuance are dependent upon the relation of the ratio of the number of degree days of thaw per year to the number of degree days of freeze, and also upon the ratio of the thermal conductivity of frozen ground to the thermal conductivity of thawed ground.

2. This latter ratio is, in turn, largely dependent upon the moisture content of the soil.

3. Observations of the elevation of the top level of permafrost which show it to be relatively constant do not necessarily indicate the permanence of the formation. The permafrost may be thawing upward from the bottom due to an increase in mean annual temperature, and may disappear altogether in a few seasons.

Arctic Ground Waters

Ground water in arctic regions exists above, below and within the permafrost. That which is below behaves like deep ground water in any climate. The water within the permafrost carves channels for its passage similar to those found in limestone bedrock. It generally is under a considerable pressure since the free level of its source is apt to be that of a lake or stream above ground.

The ground water above the permafrost behaves quite differently from that of other climates. In the summer it moves by gravity, percolating down the irregular slopes of the frost table. However, in winter, as the active layer begins to freeze downward the water becomes confined and flows under pressure. Should it become completely entrapped by the freezing of the active layer down to the permafrost layer a destructive swelling of the ground or frost mound is apt to occur.

Icing Conditions

If the water is under a considerable hydrostatic head it may burst

Fig. 5—SPECIAL 90° bend for pipe in a utilidor
Notice the flanged fittings and anchors designed for this use.

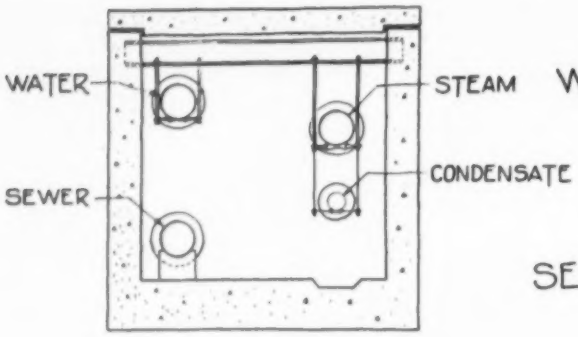


Fig. 6—BOX type utilidor
This is reinforced concrete cast in place and removable covers are provided for easy access.

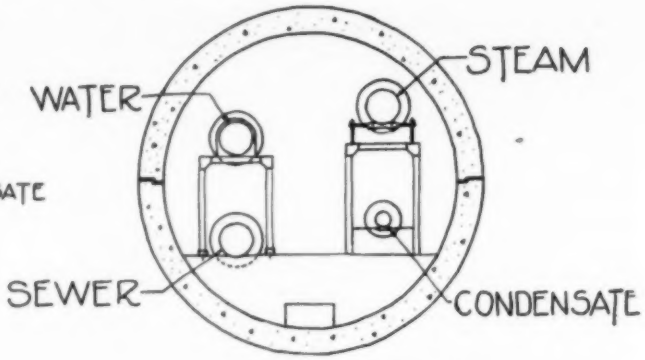


Fig. 7—CIRCULAR type utilidor
This is a precast split concrete pipe, costing less than the box type, but sacrificing accessibility.

through the top of the mound, flow out over the ground and freeze in successive thin layers. This is called an "icing." The size of an icing can take on considerable proportions when the source of ground water supply is relatively unlimited, as in the case of a connection between the intrapermafrost water and the water above the permafrost.

Ice Lenses or Layers

In addition to small uniformly distributed particles of ice found in the interstices of frozen ground, ice may also occur in the ground in large masses, usually in the form of lenses or layers. These lenses are formed either by the covering of surface frozen water by landslides or sediments, or by the freezing of ground water. An abundance of ground water generally is necessary. For this reason, ice lenses and layers are more common in low places and near the bottom of valleys than in well drained slopes of mountains.

The amount and type of ice contained in frozen ground is of extreme importance from the engineering standpoint. Thawing of this ice may produce undesired wetting and plasticity, making the soil unstable and subject to settling, caving and even flowing.

Local Thawing Effects

The effect of local thawing of the permafrost table, as under a building or around a utilities structure, is dependent upon the character of the ground and its moisture content.

A well drained granular material will not be affected at all. Although not in accord with the definition of permafrost the term "non-frost susceptible" has come to be commonly applied to this material. Frozen bedrock generally is unaffected. However, certain sedimentary rocks of the loosely cemented types may crumble upon thawing. Clays, silts and loams with large amounts of interstital ice will become fluid, having no bearing capacity whatsoever. The thawing of ice lenses in these soils having less moisture content will cause cave-ins.

It cannot be emphasized enough that data from a complete underground investigation of the site as well as all available weather information should be in the hands of the engineer before commencing the design of an arctic utilities system. The proper interpretation of this information will affect not only the workability and permanence of the system, but will also have a profound effect on the overall economy of the project.

Methods of Protecting Against Freezing

Water Distribution Systems

The measures needed to protect water conduits against freezing vary with the difference in temperature to which they are subjected and with the quantity of flow.

In the arctic many rivers freeze solidly to the bottom in the winter months, and the ground water above permafrost is apt to freeze or be contaminated; the most dependable source of water supply is from deep drilled wells tapping the subpermafrost water. Quite naturally this water is relatively cold, its temperature generally being between 35 and 40° F. It has been found that under certain conditions it is better to keep the water in distribution systems at a lower temperature, since with less difference in temperature between the water and the ground outside the pipe the rate of heat loss is decreased.

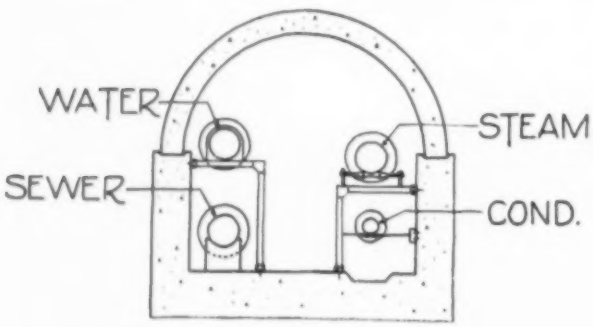


Fig. 8—SEMI-CIRCULAR type utilidor
A combination of the box and circular types. Costs less than the box type, but sacrifices some features.

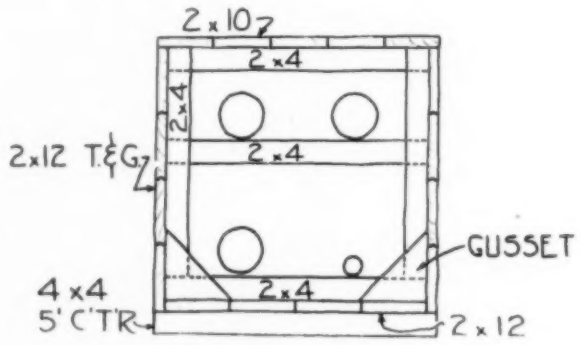


Fig. 9—WOOD type utilidor
These are not for permanent installations, as their useful life is shorter and maintenance costs are greater.

Large supply mains with continuous flow require little or no protection. However, as the population of the communities and military bases located in arctic Alaska is as yet quite small, mains of this type have never been used.

Also little protection need be given to large distribution mains, say those over 12-inch diameter, provided that a fairly good flow is evident during periods of low demand and that they are looped to prevent any dead ends. Small distribution mains and house services must definitely have some form of supplemental protection to prevent them from freezing.

Sewage Collection Systems

Sewage issuing from arctic homes is approximately the same temperature as that in any other climate—room temperature or about 70° F. However, the flow in submains, laterals and house connections is very intermittent and they must be fully protected against freezing. Large mains and outfalls, 20 inches in diameter and greater, have been built and are being used without protection of any type against freezing.

Steam Heat is Used

At large military bases in Alaska it has been found economical to provide a central heating and power plant. Electrical energy is generated by means of high pressure steam turbines. Steam is extracted from these turbines at some lower pressure, usually 50 or 100 psi, and distributed to the buildings to be heated by means of underground pipes. The condensate is returned to the plant by pumped return lines laid along the same routes. Some additional steam must be supplied during the very cold months. This type of installation is not unknown in the northern United States and southern Canada where the "waste steam" from the power plant is used to heat buildings in the business district.

Installations of this type north of the range also solve the problem of protecting the other utilities. It is necessary only to construct underground conduits large enough to carry all of the utilities. The heat given off by the steam mains—even though insulated—is sufficient to keep the inside of these utilidors, as they are called, well above freezing.

Construction photographs, Figs. 1-5, illustrate details of concrete box conduits which include steam lines, and also of a cement base conduit using vermiculite concrete for insulation.

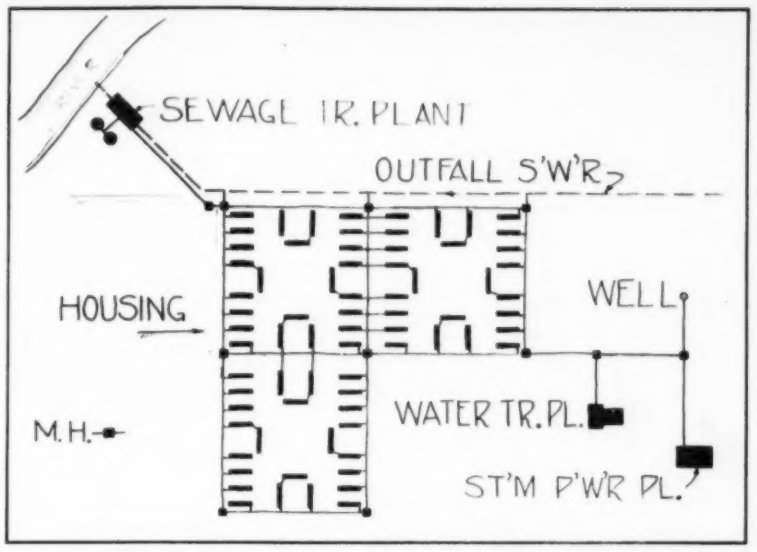


Fig. 10—LAYOUT for typical utilidor system serving a military installation

The "Utilidor" is an Underground Conduit

Fig. 6 illustrates the cross-section of the most common type of permanently constructed utilidor. It is a reinforced concrete box type conduit cast in place, having precast removable covers providing easy access for replacing pipe. Notice that the sewer is placed well below the water main to guard against any possible cross connection. A drainage gutter is provided in the floor to catch any leakage from the pipes and any infiltration that might occur. This drainage is transferred to the sewer by sump pumps placed at low points in the utilidor system.

An alternate cross section which offers the advantage of less cost but sacrifices accessibility, is shown in Fig. 7. A precast split concrete pipe is used to carry the utilities. Split sections of corrugated iron culvert pipe or wood stave pipe may also serve the purpose. A cross section which combines the features of the other two, is shown in Fig. 8, the lower half being a box and the upper half a split section of concrete pipe. Generally the cost advantage of this type is not enough to warrant sacrifice of the features of the full box type.

Permanent Installations

For serving permanent installations, utilidors should be constructed of reinforced concrete. However, when buildings of a temporary nature are being served or as an expedient when sufficient funds are not available, utilidors of wood are fully adequate. Fig. 9 shows a box type utilidor constructed of wood. Of course it is understood that useful life of this material is much shorter and annual maintenance costs much greater.

The layout for a typical utilidor system for a military installation north of the range is shown in Fig. 10. Manholes are placed at all intersections of the main utilidor and at intervals of not over 300 feet to provide access to valves, expansion joints and sewer cleanouts. Only the service sewers, laterals and small sub-mains are carried within the utilidor, the outfall sewer to the treatment plant being large enough to prevent freezing.

Fig. 11 shows the method of bringing the utilities from the main utilidor into a building.

In small communities where central heating is uneconomical the utilidor system may still be used. A small steam plant is necessary, the utilidors being heated by steam tracers. These small steam pipes act both as distribution and return lines. They must be so graded that the condensate may return by gravity to the steam plant.

For tactical reasons, utilidors at military stations must be large enough to crawl through or even to walk through. Interruption of heating service to any building at —60° F will make impossible continued occupation within a short period. In small communities without central heating the utilidors need only be large enough to carry the pipes involved. Two feet by two feet is generally ample.

In lieu of utilidors, conduits of insulating material may be used with or without steam tracers. Several

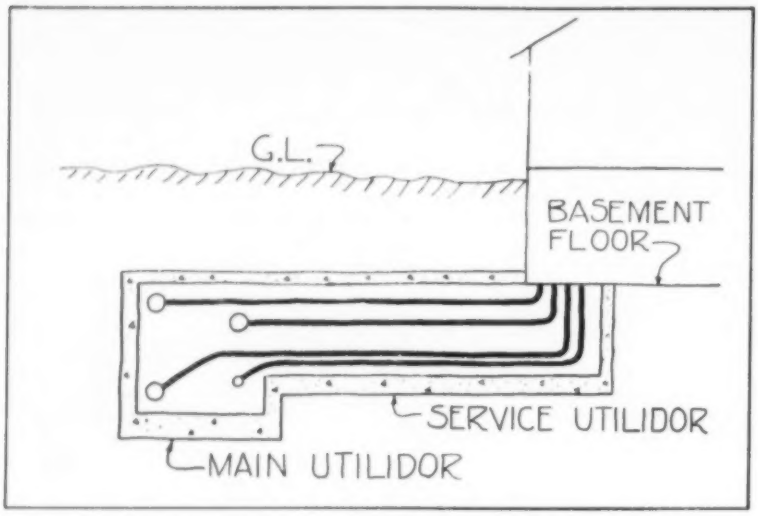


Fig. 11—CONNECTION of utilities from main utilidor into a building

types of insulating conduits are being offered on the market for use underground. One is capable of being poured in place like concrete. Others are prefabricated. The greatest disadvantage to these conduits lies in the fact that if ground water penetrates them they lose their insulating value. Research is going on to develop inexpensive insulating materials which either resist the penetration of water or whose insulating qualities do not change materially when wet. One or two have appeared on the market which claim to have these properties but are as yet relatively untested.

The Recirculation System

Another method of approach to the problem of water system freezing is the recirculating system. There are two types:

1. The dual main system.
2. The single main system.

The firm of Black and Veatch of Kansas City designed a recirculating system for Fairbanks in 1944, but this system never has been constructed. A few very small systems have been constructed in Alaska and operated with some difficulty but no large recirculating systems are in use as yet.

The recirculating system consists of a distribution main, a water return main, circulating pumps and a water heating system. The dual main system as shown in Fig. 12 consists of a high and low pressure line placed side by side. The service connection takes water from the high pressure main and returns the unused portion to the low pressure main.

Fig. 13 shows the layout of a single main recirculation system in which the distribution and return mains form one continuous loop starting and ending with the pumps.

Service Connections

Service connections are protected by any of the methods heretofore described, by electrical heating cable or by use of the thermal tap. Theoretically, this type of tap takes warm water from the top of the pipe into the building being served and returns cool unused water and injects it into the main. It has been found that the insertion of an orfice in the main at a point such that the return tap is in the area of low pressure, will positively make this type of tap operable. Another suggestion is the use of a very small pump on each premise to keep the water in the service connections circulating.

Heat losses in a recirculating system must be kept as small as possible. The water is heated only to that degree which will allow its return to the pumping plant slightly above freezing. High velocities, with the accompanying turbulence, should be avoided since heat is dissipated more rapidly under these conditions.

Careful thought should be given to the materials from which the pipelines are constructed. Asbestos cement and wood stave pipe have the best insulating value. If conditions are such that the insulating value would not be destroyed by ground water, consideration should be given to the use of cheap insulating material such as peat or moss around the pipes.

Sewer Protection

Since one of the purposes of the recirculating system is to eliminate costly utilidors, sewers are placed directly in the ground. Certain measures may be taken to conserve the heat already contained and to make the greatest use of any natural heat available.

Sewers should be located to avoid compaction of the soil above them or outside the limits of traveled roadways as much as possible. Greatest use should be made of protective snow and vegetative cover. However, sewers should be so located that they are in ground which is not in shadow when the sun is shining. If necessary, trees should be cleared back on the south side of

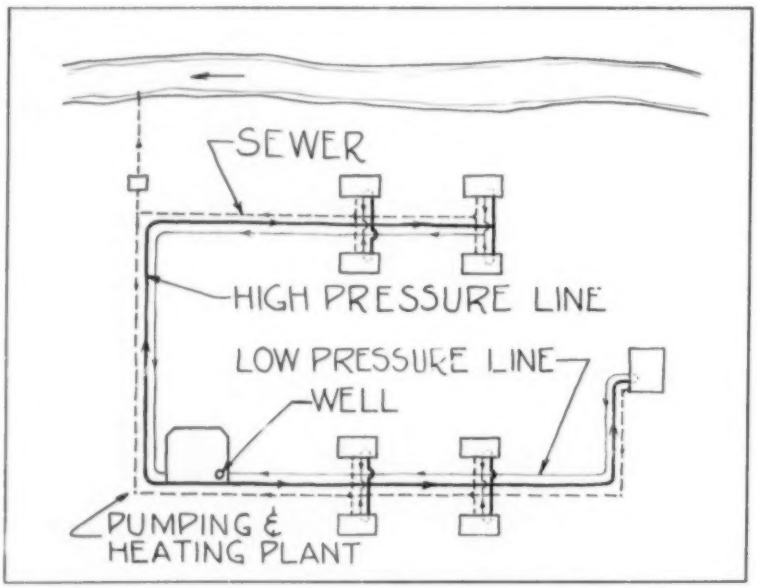


Fig. 12—DUAL MAIN system has high and low pressure lines placed side by side

the sewer line to allow the sunlight to reach the ground.

As with the water mains, care must be taken to use sewer materials of relatively high insulation value, and insulating materials must also be placed around the pipe. If the sewer is in ground water, insulation is useless, except perhaps, those special types previously mentioned. However, some advantage is gained from the latent heat of fusion of the water.

Sewer Venting

Special arrangements are necessary in venting this type of sewer system. Standard methods of venting both manholes and house plumbing permit the loss of too much heat from the sewer during periods of extremely cold weather. Experience at Fairbanks, Alaska, where a standard design sewer system is in use, shows a definite relationship between air temperatures and sewer freezing even though these effects are not noticeable in the upper layers of the ground above the sewer prior to freezing.

Laminar flow, or flow with very little turbulence, is preferable in arctic sewers. Excessive turbulence may be avoided by keeping the velocity at the minimum necessary to prevent deposition of solids and by eliminating surface irregularities inside the sewer at the time of construction.

Heating Cable

Some mention must be made of electrical heating cable. This is simply a high resistance wire insulated to withstand conditions underground. It has been used for years for heating plant beds in greenhouses. Even though this cable can be thermostatically controlled, either by water or air temperatures, its operating cost is generally excessive. However it is a "handy man" to have around for odd jobs.

As mentioned before, heating cable can be used for protecting house connections if the individual householder is willing to assume the expense. For short runs this is economically justifiable. Also, it may be used as a standby unit when computations indicate that a sewer or water main probably will not freeze. One definite advantage to this cable is its ability when in place to thaw an undamaged frozen pipe and restore it to service.

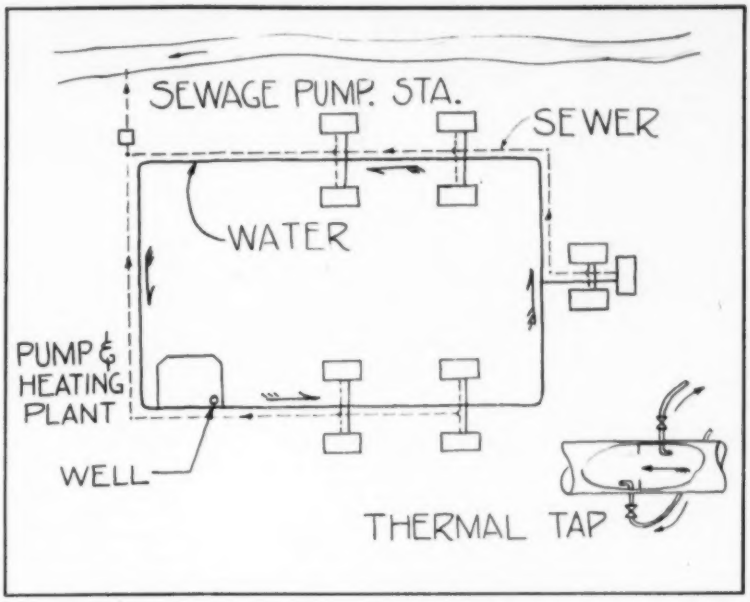


Fig. 13—SINGLE MAIN recirculating system and detail of the "thermal tap" to protect service connections

Effect of Permafrost

Measures must be taken to provide structurally sound foundations for all types of underground utilities heretofore mentioned. Since these utilities all are maintained above freezing, some thawing will occur when they are laid in or in most cases over permafrost. This effect is greatest in the case of utilidors and less great in other systems.

Should the permafrost consist of material which becomes unstable upon thawing, it is necessary to excavate well below the permafrost table and backfill with non-frost susceptible material to the level of the conduit being laid. In extreme cases, construction upon piles imbedded well into the permafrost is indicated.

Under the most extreme conditions, construction may be so difficult in trenches that disturbing the original ground is completely avoided. A gravel mat is placed atop the ground, the conduit is laid upon it, and earth is mounded over the installation to provide insulation. Utilidors, when well insulated, can be placed atop the ground either on piles or a gravel mat without protective earth cover.

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Fluoride Effects Studied at Colorado Springs

The U. S. public health service will conduct a dental research investigation at Colorado Springs, Colo. to find out why children in that city still have tooth decay and the water has a high fluorine content.

The study will be part of a nationwide investigation on effects of fluoride ion on all structures of the body.

St. Louis County Water Co. Plans Increased Capacity

W. Victor Weir, president, St. Louis County Water Co., has announced that by next summer capacity will be increased 17% to 75,000,000 gallons per day. This capacity represents an upward revision of the three-year construction program announced last year from $7,750,000 to about $10,000,000. The expansion will increase the size of some planned mains, add three 2,500,000-gallon storage tanks and provide improvement in the coagulating basin at the Hog Hollow plant.

Operation of Small Water Works

Getting Out of a Jam

by **A. E. CLARK**, *Manager, Nashville Suburban Utility Dist., Nashville, Tenn.*

GETTING out of a jam is nothing new to waterworks men. The following experience with the installation of an emergency pipeline may be of interest, although it is not out of the ordinary.

During prolonged droughts and high temperatures an unusual strain is put on many water utilities. High temperatures and dry spells are not unusual at Nashville, but a prolonged combination of both is exceptional.

Starting on June 3, 1952, the maximum temperature was 90 degrees, and from then on *for a period of 27 days* the temperature exceeded 90 degrees every day and was 100 degrees or higher on 11 days. The average daily maximum during this period was 96.7 degrees. The average annual June rainfall is 4.00 inches. During this June the actual rainfall was 0.78 inches.

The results of the heat and dry weather showed up rapidly in increased water consumption. Sprinkling of lawns, shrubs and flowers increased to the point where approximately 300 consumers were without water for periods of time varying from 2 to 6 hours. Telephone calls came in one after another, because consumers were without water during the dinner hour—which also coincided with the maximum use of water for sprinkling. The time the first callers reported being without water was about five p.m., and others would say they were without water up to about six p.m. Service was again available around eight to eight thirty p.m., and from then on until ten or eleven p.m., depending on the location of the consumer. This condition occurred for three or four days at which time, and since there was no prospect of rain or lowering of the daily temperatures, it was evident that something would have to be done and done quickly.

A Temporary Connection to a New Feeder Main

A project already under construction consisted of a 16 in. feeder main and a new pumping station. The preliminary work, such as estimating the cost, drawing plans, issuing the bonds, acquiring property and right of ways, was started the preceding summer in order that it could be completed by May 1, 1952. This date was set anticipating a recurrence of the drought which had started about the first of April of the previous year. That drought had already been the cause of considerable comment, and a study had been made of ways and means to eliminate a similar condition. Due to delays in acquiring property, permits, and materials, the project had been delayed so that the completion date was estimated to be Sept. 15, 1952.

The 16 in. feeder main had been installed, from the connection with the existing 16 in. supply main which will supply the new main and pumping station, to within approximately 200 feet of the new pumping station. The distance of the new pumping station from the 16 in. supply main is approximately 900 feet. It was decided to utilize the portion of the new feeder main already installed by making a temporary connection between the 16 in. supply main and the new 16 in. line, a distance of 1311 feet.

The first problem was what size pipe to lay. This was calculated to be 8 in. pipe. The next problem was where to get the pipe in a hurry. A telephone call was placed on a Saturday evening to the sales manager of one of the large pipe manufacturers and he was asked how soon he could deliver 1300 feet of 8 in. mechanical joint pipe 150 class. He stated that it would be delivered the following Monday or Tuesday. In the meantime, arrangements had to be made for permits, moving a spare pump from one of the existing pumping stations, contacting the Nashville Electric Service relative to setting temporary transformers and a meter, and construction of a temporary building to house the pump and starter. Prices for laying the main were received from contractors Saturday afternoon and by Monday morning all arrangements were completed.

PUMP in temporary building
An additional supply of nearly 1 mgd was provided from this installation.

Several Crews Work at the Same Time

One contractor disconnected the pump, complete with valve and check valve, on Monday morning, moved it to the temporary site, and mounted it on railroad ties. Word was received that the pipe would arrive early Tuesday morning, therefore the pipe contractor was notified to have his crew on the job at 7:00 a.m. in order to unload the pipe. The first load arrived at 7:15 a.m., was promptly unloaded, and work started.

The plug was removed from the 16 in. feeder main and a 16 in. by 8 in. reducer was installed. Excavation was made for a distance of approximately 50 feet upgrade to the surface. The 8 in. pipe was laid and the excavation was backfilled. From that point on, the line was on the surface; first over a railroad overpass, then along the shoulder of a road where it was laid against the guard rail. As the temporary pump house was approached it was necessary to lay the pipe on timber supports—which were replaced the following day by concrete piers having straps fastened to bolts placed in the piers. The line across the overpass was tied to the concrete hand rail.

While this work was being done, construction of the temporary struc-

TEMPORARY 8 inch pipe line—over 1300 feet was laid in less than 13 hours

(Left) Mechanical joint pipe from the pump house laid along shoulder of highway. (Center) Concrete piers replaced timber supports used the first day. (Right) Pipe laid over railroad overpass. Note use of 1¼ in. steel bars as anchors—these were driven to form an A over the pipe and welded together near the top.

ture to house the pump and starter was underway. Fortunately, where the 16 in. connection was to be made to the existing 16 in. supply main, there is located a meter box which formerly housed two 6 in. master meters. Only one of the meters was being used, therefore the six inch connection for the meter which was removed was utilized for the pump suction. This saved considerable time which would have been needed to make the permanent connection with the 16 in. supply main, installing a 16 in. valve and a 16 in. by 8 in. tee. The contractor installing the pump made the necessary connections to the 6 in. meter.

Also, during the same time the power company was installing transformers and running power lines to the temporary pump house. The electrical connections for the main switch, starter and motor were begun as soon as the framing for the house was raised. Arrangements had been made with the County Electrical Inspector to check all wiring as soon as completed so that the power company could be given a release to make the connection to the pump switch. The power company installed their meter so that everything was in readiness as soon as the electrical inspector gave the power company the release, which was done at approximately 4:00 p.m.

The 8 in. line was completed at about the same time, however it was necessary to anchor the line in a number of places. This work was done by driving 1¼ in. steel bars to form an "A" over the pipe and welding the rods together at the top.

In order to measure the amount of water used at this location a new 8 in. Hersey fire flow compound meter was installed ahead of the pump. This is one of two meters to be installed at the new pumping station and will be relocated when the new station is completed and use of the temporary pump is discontinued.

An Additional Supply of One Million Gallons

By eight o'clock in the evening everything was ready and the pump was started. A noisy bearing was noted, but it was thought not to be of a serious nature. The pump operated all night and delivered at a rate of 690 gpm, or just under one million gallons per day.

With this additional supply, the area, formerly served by an 87,000 gallon standpipe, which had proved inadequate, was valved off and supplied direct from the main storage reservoir. The area now served by the standpipe has normal pressures and volumes and no complaints of lack of sufficient water. The same satisfactory condition applies to that area changed over to the main reservoir supply, and thus the main trouble area is now receiving sufficient water. Service in another small area located at a somewhat high elevation was helped by means of a cross connection to the main supplying this area from the new 16 in. feeder main.

A gain was made in the water level of the main storage reservoir the first night, but the next morning the noisy bearing in the pump was noisier. It was necessary to replace the pump bearing, which lost the service of the temporary pump for a period of four hours. After starting again at 3:00 p.m. that afternoon, it was thought that no further trouble was in prospect. How little did we know about what could happen!

One More Problem —A Blown Joint

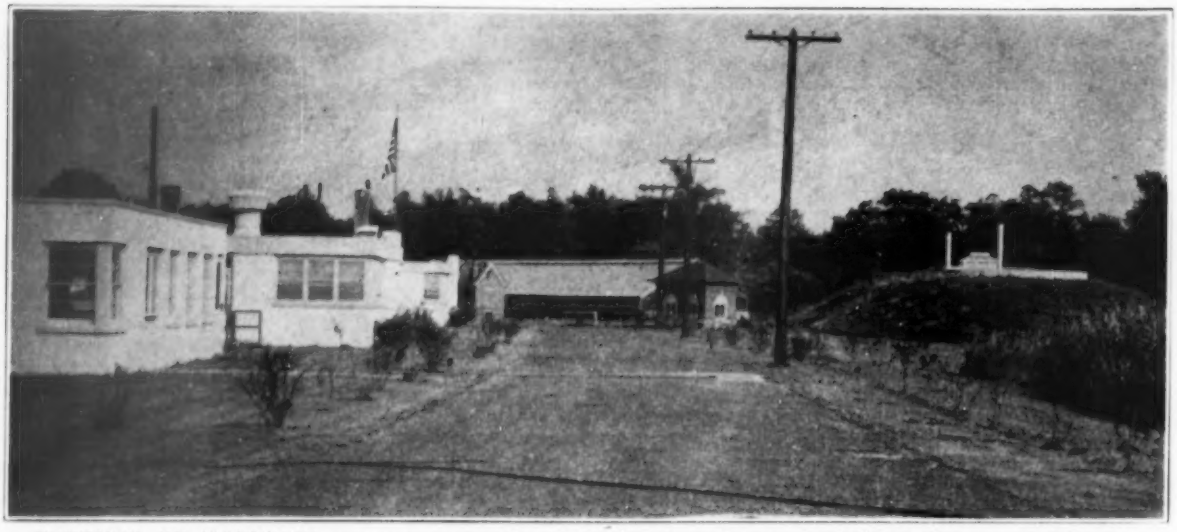
At 6:45 a.m. the next morning, a call was received at my home from a consumer stating that he was getting an early start as he had a trip to make out of town but, when he got ready to bathe, there was no water. A check was made immediately of the temporary installation and it was found that a joint had blown on the 16 in. line, the first joint back of the 16 in. by 8 in. reducer.

The pump was shut down, valves were closed, and work was started at 8:00 a.m. After excavating the joint it was found that the general contractor laying the 16 in. feeder main had broken the point too much in making a bend. It required working until 4:00 p.m. to realign the pipe, pour the joint, and backfill. However, at 4:00 p.m. of the same day the pump was started again and since that time up to the present has been operating continuously.

An Example of Cooperation

A great deal of credit must be given to the various contractors who worked on this installation for their cooperation and untiring effort to get the installation made and operating. It must be remembered that all of this work was done in the bright sun while the temperature was well above 90 degrees. The experience demonstrated what can be done if everyone works together, because in just 13 hours from starting the installation the pump was operating and one more jam was behind us.

A lesson can be learned from what happened. No matter how well a project is planned, conditions may arise which will delay its completion; therefore, a time safety factor can very well be added in order to insure completion in spite of delays. Many water utilities are now faced with expansion problems, and they will find it advantageous to keep abreast of or ahead of the necessary improvements—and in this way keep out of jams.



BOROUGH OF MAYWOOD sewage treatment plant. This view shows the operating building, glass covered sludge drying beds, and sludge digesters.

Financing Sewage Treatment on a Participation Basis—II

To Treat Sewage from Hackensack and River Edge, Maywood, N.J., Fixes Charges on Connections

by **HENRY VAN DER VLIET**, *Supt., Joint Meeting Treatment Plant, Rutherford, N. J.*

THE Borough of Maywood, N.J., constructed its first sewer system and sewage treatment plant in 1915. Only primary treatment was provided at that time, the plant consisting of one circular Imhoff tank of 200,000 gal. capacity, and several sludge drying beds.

In constructing the sewer system it was necessary to lay sewer lines both in the City of Hackensack and in the Borough of River Edge. The trunk line from Maywood ran through Hackensack and then River Edge to reach the sewage treatment plant located on the Hackensack River in the City of Hackensack. The Borough of River Edge (originally Riverside) entered into an agreement permitting sewage from that section of the Borough traversed by the trunk line to be discharged into the sewer system.

Original Agreement to Handle River Edge Sewage

It was mutually agreed that connections to the trunk sewer may be made at any time by any resident or property owner of the Borough of River Edge, provided that the Borough of Maywood shall have the right to inspect all connections made to insure that work is done thoroughly and in workmanlike manner. The charge shall not exceed 3 dollars for each connection. This agreement applied only to the trunk sewer, and not to lateral sewers in the Borough.

It was also mutually agreed that, during a period of fifteen years from the date of the agreement, for the use of the trunk sewer and the treatment of sewage, the Borough of River Edge will pay the Borough of Maywood at the end of each fiscal year the sum of $4.00 for each house connection that is made with the trunk sewer or its tributary thereto by any property owner or owners in the Borough of River Edge. River Edge also agreed to pay $4.00 per year for each connection between any lateral sewer and the Maywood trunk sewer.

Should the sewer from any building be disconnected from the trunk line or lateral sewer, the connection would be sealed under the inspection of the Borough of Maywood, and no payment shall be required for the connection thereafter.

It was further agreed between the Borough of River Edge and the Borough of Maywood that after the expiration of fifteen years from the original date of the agreement the Borough of River Edge would pay the Borough of Maywood for the use of the trunk line and sewage treatment plant on a new basis. By this agreement, the Borough of River Edge would pay its pro-rata share of the annual fixed charges and actual cost of maintenance and operation of the sewage treatment plant, and would pay its pro-rata share of the trunk line from the treatment plant to the westerly boundary line of the Borough of River Edge. The charge would be established directly in proportion to the number of house and factory connections tributary to the sewage system from each borough, and would be adjusted to the end of each fiscal year.

Consideration of Rising Costs

The agreement provides, however, the the sum payable shall not exceed $4.00 per house connection, which is to be the maximum paid by the Bor-

NEW PLANT has a design capacity of 2.0 mgd, utilizing high rate filtration, secondary settling, and chlorination.

ough of River Edge, unless by that time the Borough of Maywood has been compelled by some act of the Legislature or by some act of the State Board of Health of New Jersey to build and construct or reconstruct a more expensive disposal plant, and thus a more expensive method of treating sewage is required. That is to say, if the degree of sewage purification required is greater (whereby the Borough of Maywood is compelled to go to an increased expense in the operation of its sewage treatment plant) then the Borough of River Edge shall pay in addition its pro-rata share of the increased cost and expense of sewage treatment. The additional charges shall be determined directly in proportion to the number of house and factory connections tributary to the sewage system from each borough. The agreement provides, however, that the entire maximum charge to the Borough of River Edge shall not in any event exceed $5.00 for each connection.

In case the Borough of River Edge were at any time to construct a sewage system and sewage treatment plant, it was agreed and understood that River Edge had the right to disconnect all house connections and sewer laterals tributary to the Maywood trunk sewer. River Edge also would be relieved of all cost or payments for those connections that were withdrawn from the Maywood trunk line sewers.

Original Agreement to Handle Hackensack Sewage

The City of Hackensack subsequently entered into an agreement with the Borough of Maywood, by which Maywood agreed to receive in its trunk sewer all sewage from that section of Hackensack running substantially parallel with Coles Brook to the sewage treatment plant (but excluding surface water or other drainage). The limits of the area included are designated on a "Map of part of Hackensack showing area to be served by the Maywood Trunk Sewer." Maywood agrees to convey the sewage to its treatment plant and to dispose of it in the same manner as it does or may dispose of its own sewage. The Borough of Maywood granted the City of Hackensack the right to connect its lateral or other sewers conveying sewage from the described territory to the Maywood trunk sewer at any point at which a manhole has been or may hereafter be constructed, or at such other point as the City of Hackensack may require. In the latter case, the City of Hackensack shall at its own cost and expense construct a proper manhole, in a manner approved by the Engineer of the Borough of Maywood.

The financial consideration covering conveying and treating sewage from all the described area in the City of Hackensack involved payment to the Borough of Maywood of $26,000. At that time this was considered a large sum of money as very little development of homes or factories had taken place in the area served (less than 100 homes were located in this area). A few years later, as building progressed, this arrangement became a large issue in the Borough of Maywood.

Litigation Over Terms

A controversy arose between Maywood and Hackensack in reference to the terms and provisions of this agreement (dated 1923) in relation to disposal of sewage, and led to litigation. The case was presented to the Supreme Court of the State of New Jersey in the Law and Chancery divisions, with reference to the force, effect and validity of the terms of the original agreement, and with reference to the desire of the two parties to settle the controversy by a new agreement.

Agreements between both the City of Hackensack and the Borough of River Edge with the Borough of Maywood were gone over by all parties and no court action was taken by any party.

New Maywood-River Edge Contract In Force

A new agreement and contract was drawn September 27, 1947, between Maywood and River Edge. The most important part of this new agreement was a description of the River Edge area from which the Borough of Maywood was to take and treat sewage. Heretofore there had been no understanding of the area to be included. An area was instituted and defined so that the Borough of River Edge and the Borough of Maywood were in agreement. The area was designated on a "Map showing Sanitary Sewerage District in the Borough of River Edge, N.J." This map was in two sections: (1) the "old" section, under the old contract or agreement in the area where the trunk sewer was laid through the streets of the Borough of River Edge; and (2) the "new" section, comprising mostly new homes and apartment houses. All connections are classed as units (one connection meant one home or one apartment), and the charges are com-

TABLE 1

Certifications

The total number of sanitary connections to the Maywood Sewerage System, as listed below, are hereby certified to be correct, to the best of my knowledge and belief:

Borough of Maywood

Total number of connections to Dec. 31, 1950, previously certified	2,798
Additional connections Jan. 1, 1951 to December 31, 1951, inclusive	92
Total Maywod connections	2,890

Borough of Paramus

Total number of connections to Dec. 31, 1950, previously certified	9
Additional connections Jan. 1, 1951 to December 31, 1951, inclusive	0
Total Paramus connections	9

Borough of River Edge

Total number of connections to Dec. 31, 1950, previously certified	840
Additional connections Jan. 1, 1951 to December 31, 1951, inclusive	369
Total River Edge connections	1,209

Date: January 30, 1952 BOROUGH OF MAYWOOD

BY: .....

The total number of sanitary connections to the Maywood Sewerage System, as listed below, are hereby certified to be correct, to the best of my knowledge and belief:

City of Hackensack

Total number of connections to December 31, 1950, previously certified	1,166
Additional connections Jan. 1, 1951 to December 31, 1951, inclusive	80
Total Hackensack connections	1,246

CITY OF HACKENSACK

Date: January 30, 1952 BY: .....

City Engineer.

puted on a basis of one connection for each family using the sewer. Each business and commercial unit shall be charged as one connection; that is to say, that where two or more businesses are in one building, each business counts as one connection.

River Edge Charges

The Borough of River Edge and the Borough of Maywood agreed that payments applying to the "new" section of River Edge should be computed on an actual cost basis. These payments shall be determined by dividing the number of house connections into the total amount of all expenditures made by the Borough of Maywood during the calendar year for the maintenance and operation of its sewage disposal system. There shall not be included in this cost any amounts paid by the Borough of Maywood for interest or amortization of existing obligations issued to finance the cost of the present sewage system and treatment plant of the Borough of Maywood. After the date of the new agreement, repairs, alteration, extension or enlargement of the sewage treatment plant shall be included as an expenditure for the purpose of determining the "actual cost basis."

As to the "old" section of River Edge defined in the new agreement, there was a change in charges. In 1916 the cost by agreement was $4.00 per connection; also, by the original agreement the amount could be increased only $1.00 per connection. That amount was specific, and the Borough of River Edge would agree only to the $1.00 increase in the new agreement. This is in effect at the present time.

A map on file at the Borough Clerk's office is used at the end of each calendar year to compute the number of connections; the same map is used to record all new connections made in both the "old" and "new" sections of River Edge. The auditor for the Borough of Maywood computes the charges at that time and the Borough of River Edge is billed for "old" connections at a straight $5.00 cost per connection and for "new" connections on an "actual" cost basis.

New Maywood-Hackensack Contract in Force

As to the new agreement with the City of Hackensack and the Borough of Maywood, which went into effect January 1, 1949, Hackensack will pay annually to Maywood a percentage of the cost of operation of the trunk sewer and disposal plant determined by the number of Hackensack units in the area designated, less 125 units. The amount of 125 units was agreed upon to cover the original cost to the City of Hackensack of $23,000 which was paid to the Borough of Maywood.

Under the Hackensack agreement, a unit is defined as a single housekeeping unit, or each 4 persons of the average number of employees of each place of business. This is the only difference between the River Edge contract and the Hackensack contract; thus, they mean almost the same.

Hackensack Charges

The cost of operation shall be considered the annual current expense maintenance of the trunk sewer and sewage treatment plant; together with interest on the presently existing debt (but exclusive of the principal of said debt) chargeable against the trunk sewer and treatment plant; and also the annual cost of any necessary renovations, replacements or enlargements of both the trunk sewer and the treatment plant, which cost shall be amortized in equal installments for the longest period of time authorized by the Municipal Bond act of the State of New Jersey.

All the provisions of this new agreement shall be subject to a joint interpretation and determination by the Borough Auditor of Maywood and the City Manager of Hackensack; computation of any and all costs shall also be subject to their joint approval and to acceptance by Resolution of the Governing Bodies of Maywood and Hackensack. In the event that parties are unable to agree as to the necessity for or the cost of any work in the nature of improvements, replacements, or enlargements to the trunk sewer and treatment plant, the question shall be referred to the respective engineers of Maywood and Hackensack, and their determination shall be binding upon both parties. In the event any dispute shall arise between the two engineers, the members of the governing bodies of Maywood and Hackensack, by a majority vote, shall select an impartial third person, and the determination of two of the three shall be final and conclusive.

The only difference between Maywood's agreement with the City of Hackensack and the Borough of River Edge is that the City of Hackensack aids in the payment of any cost to the trunk sewer, in proportion to the number of Hackensack connections that enter the trunk sewer. The Borough of River Edge does not participate in the cost of repairs, replacement of pipe, or manholes for the trunk sewer.

Certification of Connections

When the new contracts were drawn, both for the City of Hackensack and the Borough of River Edge, a count was made of all the existing connections of the Borough of Maywood, the Borough of River Edge and the City of Hackensack. Also, a count was made of a right of way in the Borough of Paramus which is counted under the Maywood connections as this right of way was required for the trunk line at the time of construction in order to reach the treatment plant. The entire count was made in the year 1927 for the Borough of River Edge and in 1949 in the City of Hackensack. This count was verified by the Borough of Maywood to the City of Hackensack and

to the Borough of River Edge, and a certification is made yearly. A typical certification of connections is illustrated in Table 1. The total number of connections is certified at the end of each fiscal year as of December 31. To arrive at the entire number that will be certified, the City of Hackensack, Borough of River Edge and the Borough of Maywood issue a permit for installation of each connection during the year; the permits are counted and added to the certification of the previous year. These connections are spot checked after the number is submitted at the end of each year.

Cost Computations

The Borough of River Edge supplies the Borough of Maywood with a map at end of the fiscal year showing the added connections for the year. All connections for the past years are noted on the map. This is done so that a check may be made of any one year. Vouchers are rendered to the City of Hackensack and the Borough of River Edge for their per capita cost as of the certification made by the Engineer of the City of Hackensack and the author for the Borough of Maywood.

This arrangement of a per capita cost basis has worked out very well with all concerned. All costs are set up in the budget for anticipated revenue, using the count of the previous year for connections in the participating areas. The entire number of connections is divided into the cost of maintenance of the sewage treatment plant. All other costs (improvements, replacements or enlargements) are paid after the engineers of the City of Hackensack and Borough of Maywood have certified as to their share in the undertaking. Table 2 is a summary listing sanitary conections to the Maywood sewage system.

TABLE 2

SANITARY CONNECTIONS TO MAYWOOD SEWAGE SYSTEM

Number of Connections, As of December 31, 1951		
Connections Borough of Maywood	2,890	
Connections Borough of Paramus	9	
Connections Borough of River Edge	1,209	
Total Connections Maywood, Paramus, River Edge		4,108
Total Connections City of Hackensack		1,246
Total Connections to Maywood Sewage System		5,354

Plant Enlargement Required

In 1915, when Maywood constructed its treatment plant, the population served was less than 2000. Wastes were also treated from two industries of chemical nature. The chemical plants constructed their own sewage systems and discharged all wastes into the trunk line. The Borough of Maywood had jurisdiction of the trunk line at all times, and thus jurisdiction of the industrial wastes. This arrangement benefited the treatment plant when the sewage was concentrated, as the industries would allow condensing water to enter the sewerage system and dilute the concentrated sewage.

As more and more connections were made to the trunk line, and as more sewage was received at the treatment plant, it became necessary in the year 1929 to enlarge the treatment plant to properly treat the sewerage. No change was made in the treatment process, but added capacity was required. New tanks were built and the circular Imhoff tank was continued in use. The new rectangular Imhoff tanks provided a capacity of 900,000 gal. which, with the original 200,000 gal., gave the plant a capacity of 1.1 mgd.

A rapid growth of home and apartment house construction was made in this area during the 1930's, thus connecting a larger population than the sewage treatment plant could handle. It gradually became necessary to make another addition to the treatment plant. The need became more serious until 1943, when an extensive survey was made to correct the condition; an "order of necessity" was made upon the State Board of Health to allow the Borough of Maywood to increase its bonded debt in order to construct a new plant. Engineers made a survey and found it would be more economical to build a new plant than to make the necessary additions.

New Treatment Plant

In 1946 a new sewage treatment plant was put into operation. This consists of a mechanically cleaned bar screen, triturator, mechanical grit chambers, mechanical grit removers, flow measuring device, preliminary settling tanks, aero filters, secondary settling units, chlorination, separate sludge digestion units with gas utilization, glass covered sludge drying beds, supernatant lagoon, and various pumping units.

The plant was designed for treating a flow of 2.0 mgd, providing 2.36 hours detention time for the primary tanks, 1.59 hours for secondary tanks, and sludge digestion capacity of 3.8 cu. ft. per capita.

Fluoridation Investigated by British Scientists

Impartial Observers Recommend Adoption in Great Britain

Further confirmation of the safety and effectiveness of the fluoridation of public water supplies is provided in recommendations made by a scientific team of impartial observers from another country, The Journal of the American Dental Association reported in September.

A mission of British scientists, following an extensive three months' investigation in the United States and Canada last year, urged that the measure be considered for adoption in Great Britain. Their recommendations are contained in a recently-issued British government White Paper.

An editorial in the A.D.A. Journal cited the three conclusions reached by the investigators:

1. The procedure will "without doubt" reduce the rate of tooth decay materially.

2. No evidence exists of any difference in the biological effect of so-called artificially fluoridated water and that of naturally fluoridated water.

3. No evidence exists of harm to the health from consumption of fluorides at recommended levels.

"The researchers take into full account the opinions of those who would stop further fluoridation until still more research is amassed," The Journal said.

"They discount those opinions, however, by observing that millions of people live long and healthily even though, through the necessity of circumstance and environment, they drink only water with a higher fluorine content than is recommended for the control of caries (tooth decay).

"It is apparent that members of the British mission, like their American colleagues, have found no evidence that the continued consumption of water containing one part per million of fluorine is in any way harmful."

No Water, No School

In Athens, W. Va., Concord College's 745 students are enjoying an unexpected and indefinite vacation.

Dr. Virgil H. Stewart, president of the college, said all classes have been postponed "until further notice" because of a "critical municipal water shortage."

Mayor Rouse B. Cook said the college consumes more than half the town's water supply.

Fundamental Principles of Handling Chlorine

IV—Hypochlorites

by **V. W. LANGWORTHY**, *Research Chemist, The Chlorine Institute, Inc., New York*

Chlorine is a widely used tool in the treatment of water, sewage, and industrial wastes. Fundamental knowledge of handling this tool is important because of its potentially hazardous characteristics.

In this series of articles on handling chlorine, Mr. Langworthy summarizes useful information and describes good practices. Each article has been designed to be of practical value to all users of chlorine.

CALCIUM and sodium hypochlorites, often referred to as bleaches, have long been established in the sanitary field as sources of chlorine. The true calcium hypochlorite is particularly useful in this field, due to its concentrated form and ease of handling. It has not been possible to produce sodium hypochlorite as a stable powder, thus its use in the treatment of water and waste is somewhat limited. The uses and handling of these hypochlorites, together with the equipment commonly used in applying them, will be reviewed in this discussion.

Calcium Hypochlorite

Manufacturing techniques have advanced to the point where a relatively stable calcium hypochlorite containing 70 per cent available chlorine is produced. It is important to plant operators that the available chlorine content of successive shipments can be depended upon, with no major changes being required in pump settings or for preparing stock solutions.

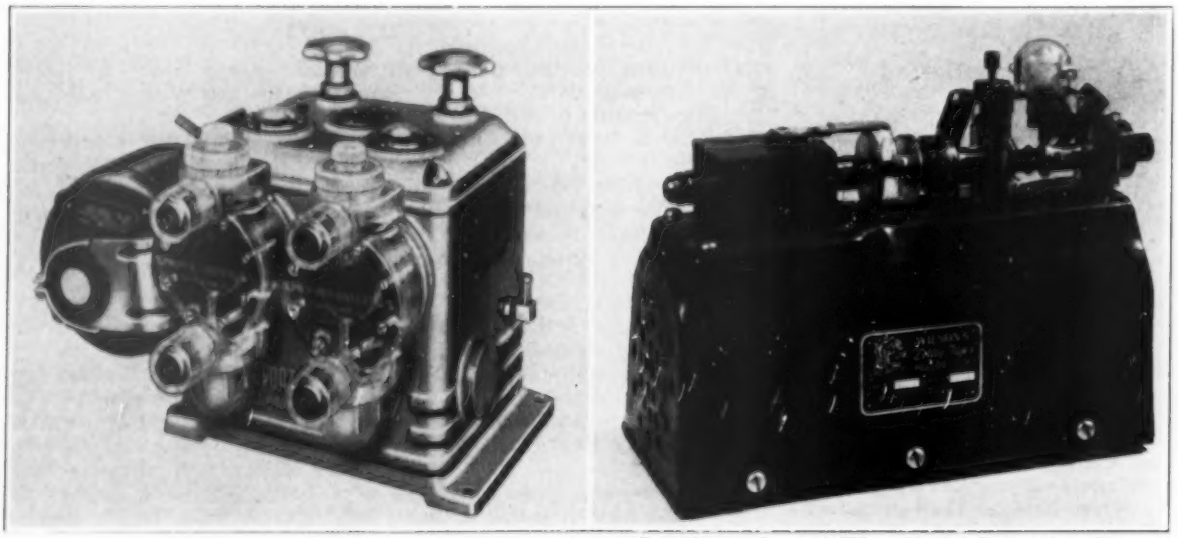
Granular in texture, today's calcium hypochlorite is a dry white powder having a minimum of dusty fines. Reduction in caking tendencies has been accomplished by holding the calcium chloride concentration to a minimum. Stored in a dry atmosphere and kept in covered containers, lumping may be avoided.

Five pound, re-sealable cans and one-hundred pound drums are the package units generally found convenient by sanitation users. It should be noted that the one-hundred pound drum is suitable for larger continuous users, while the five pound can should be specified where all of the contents will not be used immediately after opening.

Calcium hypochlorite, generally termed "high test" hypochlorite, may be utilized to serve any and all of the functions of gaseous chlorine, including disinfection, odor control, BOD reduction, control of sludge bulking, main sterilization, industrial waste oxidation and swimming pool sanitation. It is a product capable of providing readily available chlorine for emergency situations, even in large water and waste treatment plants.

Handling Calcium Hypochlorite

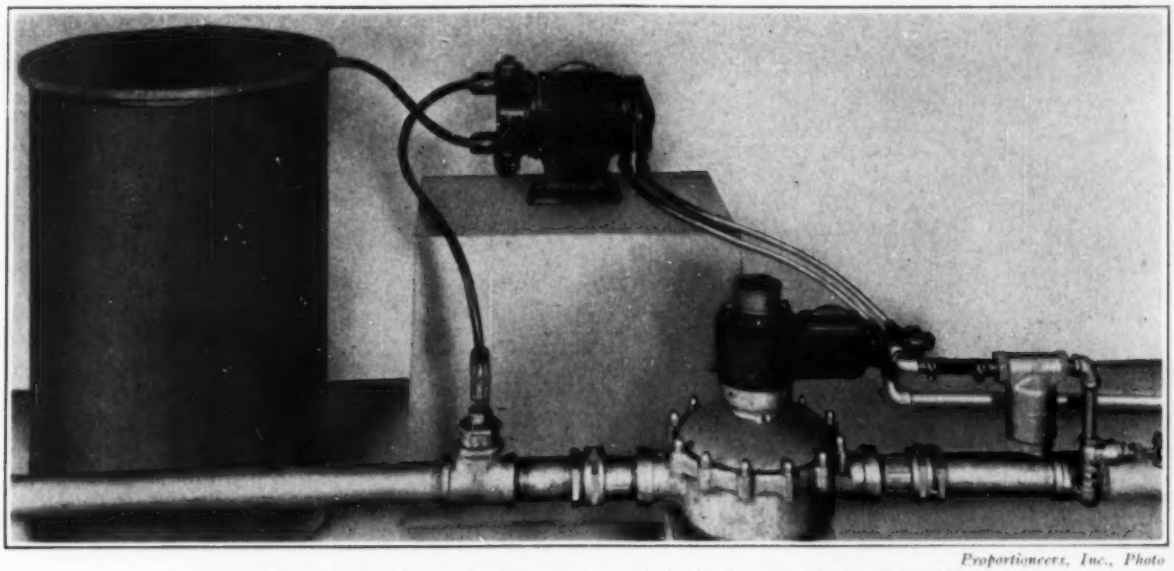
Calcium hypochlorite is termed "relatively stable" because it is a highly active compound. Its activity creates a serious problem for the manufacturer: to produce a compound with maximum reactivity, yet one which will remain stable throughout production, packing, distribution and storage. It could be assumed that product deterioration will begin as soon as the packing operation is completed, yet the facts are that storage at 86° F for one year will reduce the available chlorine only 10 percent of that originally present. Cooler



Proportioneers, Inc., and Wilson Chemical Feeders, Inc., Photos

HYPOCHLORITE solution feeders of the positive displacement type

Fig. 1 (left) is a diaphragm type feeder which may be used to dispense two separate solutions or, by manifolding the discharge ports, one solution at double capacity. Fig. 2 (right) is a plunger type feeder.



Proportioneers, Inc., Photo

Fig. 3—INSTALLATION of automatic and proportional hydraulically operated hypochlorite feeder
Water flows through the meter maintain a set dosage rate in proportion to rate of flow.

storage temperatures decrease even this small loss[1].

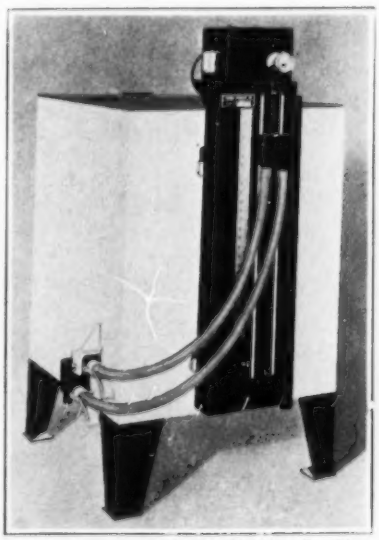
There is a problem involved in selecting the proper storage place for this useful and powerful chemical. Certainly, in the interests of preserving purchased available chlorine, low storage temperatures are indicated. While relatively stable under normal atmospheric conditions, reaction may occur spontaneously between hypochlorite and such organic substances as turpentine, ether, oils, sugar, fats and other oxidizable materials. For this reason implements, such as scoops, should be clean and dry when handling calcium hypochlorite. It also follows that the storage location should be well away from all combustible material. Rubber gloves and protective aprons should be worn when preparing and handling solutions of hypochlorite for any purpose.

Feeding Calcium Hypochlorite

Feeders for applying hypochlorite solutions require less investment than gaseous chlorine dispensers, a condition favoring their use in smaller treatment works. No attempt will be made here to specify at what flow rates one material should be selected over another, since variables such as chlorine demand and local requirements considerably alter installation selections.

Calcium hypochlorite is readily soluble in water. It is possible, therefore, to prepare solutions of varying concentrations, depending on the dosage required and the desired frequency of preparation. As is true with all chlorine solutions, materials resistant to corrosive attack should be used. Wooden, ceramic, or suitably coated steel dissolving tanks, and specially constructed feeding devices, will contribute to a satisfactory installation requiring a minimum of maintenance. As the granular product is free flowing, it may temporarily be dispensed through suitable resistant dry feeding equipment.

Numerous types of feeding devices are available which may be adjusted manually for dosage control; or dosage may be automatically regulated proportional to the flow treated.



Omega Machine Co. Photo

Fig. 4—LOWERING orifice type feeder
Electric drive operation of unit mounted on rubber lined tank.

Feeding "Chlorinated Lime" and "Soda Bleach"

Commercial chloride of lime or, properly speaking, "chlorinated lime," is a dry white powder containing about 35 per cent available chlorine when fresh. When exposed to air, this material rapidly absorbs moisture, becomes gummy, and its chlorine content is reduced. As a result, standard strength solutions of chlorinated lime can be prepared only by making an analysis of each batch for available chlorine. Obviously, chlorinated lime cannot be dispensed by dry feed devices.

Sodium hypochlorite or "soda bleach" solutions commercially available usually contain about 15 per cent available chlorine. The excess alkali present makes these solutions relatively stable: fresh solutions stored in a cool, dark location should be stable for at least three months. The stock solution may be applied as such, or may be diluted, to feed a relatively fixed concentration of available chlorine.

For sanitation uses the stability and convenience of true calcium hypochlorite (the "high test" hypochlorite) makes it superior to chlorinated lime and soda bleach. Except for emergency use, or for some special local condition, chlorinated lime and soda bleach are now considered impractical or too costly as sources of water and waste treatment chlorine.

Solution Feed of Hypochlorites

Two general types of equipment for feeding hypochlorite solutions are

Precision Machine Co. Photo

Fig. 5—HYPOCHLORITE feeder

available to the sanitary field: (1) Constant rate feeders, which require manual adjustment of rate, and (2) Proportional rate feeders, which automatically vary the delivery rate with changes in the flow being treated. Proper feeder selection depends on conditions existing at the point of application, including space requirements, water pressure conditions and supervision available[2].

Constant Rate Feeders

Delivery of hypochlorite solution at a fixed rate requires the attention of an operator to vary the dosage rate as a result of changes in water quality or flow rate at the point of application. The possibility of over or under chlorination exists, when feeding at a fixed rate, as a result of human error or insufficient sampling.

Feeders available for dosage at a constant rate usually are positive displacement, lowering orifice, or constant head orifice devices. Positive displacement units are either diaphragm (Fig. 1) or plunger (Fig. 2) type pumps, their pumping rate being a function of stroke frequency or stroke length.

Lowering orifice type devices are based on the constant level principle, with an open end hose or pipe connected at or near the bottom of the tank (Fig. 4). As the open end is lowered, the solution flows to the point of application through the connection mentioned above.

Constant head orifice devices utilize the well-known constant level float valve which provides a constant head above a calibrated orifice.

Proportional Rate Feeders

The possibility of inaccurate chlorine dosage referred to earlier is materially reduced when the feeding equipment functions proportional to flow. It is possible to adapt all the above devices to proportional flow, with the exception of constant head orifice boxes.

Where disinfection is the primary purpose of hypochlorination, uninterrupted service is mandatory. Reliance usually is placed on the installation of duplicate equipment which would be available in event of mechanical failure of the apparatus in service. Interruptions due to electrical failure would indicate that hypochlorite dispensers in continuous service should be powered either hydraulically or mechanically.

Positive displacement pumps are available which are driven by water meters, no electricity being required for operation. In these units, the dosage rate is governed by water flow through the meter (Fig. 3), thus automatically proportioning the treatment chemical. Where electric drive is permissible, the units may function proportional to flow by interconnecting with metering or pumping energy sources.

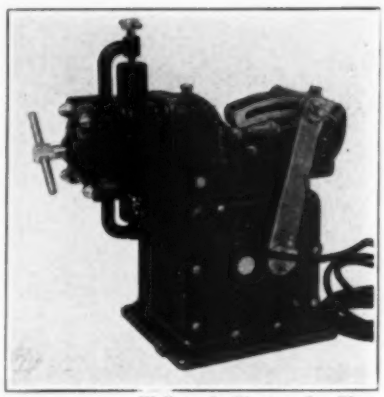
Lowering orifice type feeders may employ electric or spring driven clock mechanisms to lower the free end of the pipe or hose. Proportional flow will result if the electric current supply is tied in with metering or pumping equipment.

Recommendations

Hypochlorite dispensers have been found suitable for auxiliary disinfection equipment at small water and sewage works, to function when emergencies arise in connection with the normal chlorine gas feeding system. Figs. 5 and 6 illustrate typical hypochlorinating units. It is pointed out that such stand-by equipment should be subject to regular and rigid inspection in order to insure immediate availability. Where hypochlorinators are used exclusively, installations in duplicate should be a minimum requirement. A regular schedule of greasing and inspection should be maintained, in accordance with the manufacturer's instructions.

Spare parts needed usually are few in number, but experience will indicate the desirability of having spare tubing, check valves, diaphragm faces and gaskets on hand. Constant attention to regular maintenance will contribute to improved housekeeping as well as to efficient and economical operation.

Portable hypochlorinating equipment is available and may be used to advantage in main disinfection, or to rechlorinate the distribution system during emergencies.



Wallace & Tiernan Co. Photo

Fig. 6—HYPOCHLORITE feeder

Booklets Available

Manufacturers of calcium hypochlorinate have prepared for distribution booklets which describe in detail the uses for their product. Tabular data are included for use in disinfecting varying diameters and lengths of water mains, plus other valuable information. Following are the names and addresses of those manufacturers currently producing calcium hypochlorite:

Columbia-Southern Chemical Corp.
Gateway Center
420 Fort Duquesne Blvd.
Pittsburgh 22, Pa.

Mathieson Chemical Corp.
Mathieson Bldg.
Baltimore 3, Md.

Pennsylvania Salt Mfg. Company
1000 Widener Bldg.
Philadelphia 7, Pa.

Summary

Chlorine does not solve all treatment problems in the sanitary field, neither do the hypochlorites. Where chlorine is specific, however, calcium or sodium hypochlorite will accomplish the same objectives. Calcium hypochlorite has become predominately accepted as an emergency disinfecting compound and is often the material of choice for chlorination at small water and waste treatment works.

Acknowledgement

Appreciation is extended to those equipment manufacturers and their representatives who supplied technical information and illustrations for use in this article.

References

(1) Logan, J. O. and Savell, W. L. "Calcium Hypochlorite in Water Purification", Jour. A.W.W.A., 32:1517 (1940).

(2) Mathieson Chemical Corporation, "Hypochlorination of Water", Tech. Bulletin, 47 pages, Seventh Ed. (1951).

Recommended Procedures

In the Use of Liquid Chlorine at Water and Sewage Plants

From a Report
by

THE JOINT COMMITTEE ON CHLORINE SUPPLY

The Second and Concluding Installment

THE first installment of this timely report by the Joint Committee on Chlorine Supply was printed in our October issue. It covered the following sections of the report:

(1) Conditions of Use for Chlorine Cylinders and Ton Containers.

(2) Chlorine Inventories at Water and Sewage Treatment Plants.

(3) Transportation of Liquid Chlorine.

(4) Policy and Practices in Return of Empty Containers to Suppliers.

(5) Standing Chlorination Equipment.

(6) Stationary Bulk Storage of Liquid Chlorine.

(7) Procedures for Procurement of Chlorine in Case of Emergency.

This concluding installment of the report discusses:

(8) Safety in the Use of Handling of Chlorine and presents a complete listing of—

(9) Liquid Chlorine Producers and Repackagers in the United States, Canada and Cuba.

(10) Producers of Dry Hypochlorites.

(11) Manufacturers of Chlorinators and Solution Feed Units for Hypochlorites.

THE USE AND HANDLING OF CHLORINE —SAFE PRACTICES

It is essential for persons responsible for the handling and application of chlorine at any installation to have a relatively comprehensive knowledge of the characteristics and properties of chlorine. It is not possible to establish a general set of rules or procedures that will assure safe use and handling of chlorine in all situations which may be encountered. For some situations, adequate safety will necessitate sound judgment and decisions based on a knowledge of the properties and effects of chlorine, and of the fundamental design characteristics of chlorine applicators and other appurtenances. It is believed that users should at least be familiar with the contents of the "Chlorine Manual" published for free distribution as a public service by The Chlorine Institute, Inc., 50 East 41st St., New York City, or its equivalent, and have a copy readily available for reference at all times.

GENERAL RECOMMENDATIONS:

1. Only reliable men whose training in the handling of chlorine is commensurate with their responsibilities should be permitted to handle chlorine.

2. Chlorine and chlorinator rooms should be provided with adequate ventilation. In large installations, subsurface installations, or in buildings occupied by persons or containing equipment subject to chlorine attack, a separate and reasonably gas-tight room, equipped with mechanical ventilation which will change the air twice every minute, is considered essential and is required by some local and state regulations. Exhaust duct ports should be at floor level and ducts should terminate through a completely separate exhaust system to a location high enough to insure atmospheric dilution without endangering personnel or adversely affecting property in the area. Air inlets should be located across the room from exhaust ports, with the air of such temperature that it will not affect the chlorination equipment adversely.

Shutoff valves should be provided near chlorinators if the connected chlorine containers are in a separate room or a considerable distance from the chlorinators. Switches for fans and lights should be outside the room, at the entrance. The vent hose for the chlorinator should discharge to the outside atmosphere, above grade.

3. A suitable number of gas masks of types approved by the United States Bureau of Mines for chlorine should be provided and persons employed in the handling of chlorine should be trained in the use and maintenance of the masks. Gas masks should be located outside the probable area of contamination so that it will be possible to reach them in case of emergency. Where chlorine is used over wide areas, masks should be available in several locations.

4. To test for chlorine leaks. Attach a cloth to one end of a stick, soak the cloth with ammonia-water, and apply to the suspected area. A white cloud of ammonium chloride will result if there is any chlorine gas leakage.

5. As soon as there is any indication of the presence of chlorine in the air, steps should be taken to correct the condition. Chlorine leaks always get worse if they are not corrected promptly. Solvay Emergency Devices, Kits "A," "B" or "C" should be available for stopping leaks in chlorine containers and men should be trained in the use of such emergency equipment. Telephone your chlorine supplier or any chlorine producer if you need help. Always wear a gas mask when correcting chlorine leaks. If a chlorine container is leaking in such a position that chlorine is escaping as liquid, the container should be turned so that chlorine gas escapes. The quantity of chlorine escaping from a gas leak is about one-fifteenth the amount that escapes from a liquid leak through the same size hole. At regular points of storage and use, emergency preparations should be made for disposing of chlorine from leaking cylinders or ton containers. Chlorine may be absorbed in caustic soda, soda ash, or hydrated lime solution. Caustic soda is recommended as it absorbs chlorine most readily. The proportions of alkali and water preferred for this purpose are given in the following table:

RECOMMENDED ALKALINE SOLUTIONS FOR ABSORBING CHLORINE

Chlorine Container Lbs. Net	Caustic Soda Lbs. Chem.	Caustic Soda Gals. Water	Soda Ash Lbs. Chem.	Soda Ash Gals. Water	Hydr. Lime* Lbs. Chem.	Hydr. Lime* Gals. Water
100	125	40	300	100	125	125
150	188	60	450	150	188	188
2000	2500	800	6000	2000	2500	2500

*Hydrated lime suspension must be continuously agitated with vigor while chlorine is being absorbed.

6. Containers should be stored at a moderate temperature. Flames or direct heat should never be applied to a container. Chlorine containers con-

nected to apparatus should be protected from a temperature higher than that of the equipment. When a number of containers are connected to the same manifold, chlorine may go from the warmer containers to the colder ones, which could result in filling some above the safe limit. The heating of containers involves danger because the fusible plugs are designed to soften or melt at a temperature between 158° and 165°F. At temperatures above 180°F, dry chlorine will attack the steel of the cylinders.

7. Avoid dropping or bumping chlorine containers. Containers should be securely fastened to prevent tipping or rolling.

8. Valve protection hoods on cylinder and ton containers should always be kept in place except when such are being emptied. Never hoist cylinders by the hood.

9. Keep valves of cylinders and ton containers closed at all times when not in service.

10. Store full and empty cylinders and ton containers in different places to avoid confusion. It is good practice to tag empties.

11. Put cylinders or ton containers in service in the order in which they are received. Cylinders and ton containers in active use should be located on a scale, so that the operator may know at all times the amount of chlorine in the cylinder or ton container, and also for purpose of recording chlorine used.

12. Use nothing but approved fittings for connecting chlorine containers. Never use pipe fittings on chlorine valves.

13. The following first aid measures are recommended for persons exposed to chlorine:

First Aid, 1. Carry patient from gas area. Patient should preferably be kept in a warm room (about 70 degrees Fahrenheit). Supply blankets if necessary. Keep patient warm and quiet. Rest is essential.

First Aid, 2. Place patient on back with head and back elevated.

First Aid, 3. *Call a physician immediately.*

First Aid, 4. Splashes of liquid chlorine and chlorinated water destroy clothing, and if such clothing is next to the skin will provide irritation and acid burns. In such cases remove clothes and keep patient warm with blankets.

First Aid, 5. A carbon dioxide and oxygen mixture with not to exceed 7 per cent of carbon dioxide may be given. This mixture, ready prepared, and sold with the necessary apparatus, can be administered intermittently for periods of two minutes followed by two-minute rest periods over a total period not to exceed thirty minutes. Instructions of the purveyor of the gas apparatus should be carefully followed. If a carbon dioxide and oxygen mixture is not readily available, oxygen alone may be used.

First Aid, 6. Milk may be given in mild cases as a relief from throat irritation.

First Aid, 7. If breathing has apparently ceased, start immediately the back pressure-arm lift method of resuscitation.*

First Aid, 8. Provide First Aid as may have been prescribed by the physician pending his arrival.

*[Ed. Note: This method is described by Van Kleeck in the fourth of his series of articles—"Safety in Sewage Works Operation and Maintenance"—which is to be found in *Water & Sewage Works* for September 1953.]

Liquid Chlorine Producers in The United States, Canada and Cuba

(Lists Supplied by The Chlorine Institute, Inc.)

United States Producers

State	City	Producer	Containers Filled*		
Alabama	Huntsville	Chemical Corps (leased to Nat'l. Distillers Products Corp.)	—	—	S
Alabama	Muscle Shoals	Chemical Corps (to be leased)	—	—	S
Alabama	McIntosh	Mathieson Alabama Corp.	—	—	S
Arkansas	Pine Bluff	Chemical Corps (Leased to Diamond Alkali Co.)	—	—	S
California	Pittsburg	The Dow Chemical Co. Western Division	C	T	S
Colorado	Denver	Chemical Corps (Leased to Shell Chem. Corp.)	—	T	S
Illinois	Monsanto	Monsanto Chemical Co.	C	T	S
Kansas	Wichita	Frontier Chemical Co.	C	T	S
Kentucky	Louisville	Goodrich Chemical Co.	—	—	—
Louisiana	Baton Rouge	Ethyl Corporation	—	—	—
Louisiana	Baton Rouge	The Solvay Process Div. Allied-Chem. & Dye Corp.	C	T	S
Louisiana	Lake Charles	Columbia-Southern Chem. Corp.	C	T	S
Maryland	Edgewood	Chemical Corps (Leased to Diamond Alkali Co.)	C	T	S
Michigan	Midland	The Dow Chemical Co.	—	—	—
Michigan	Wyandotte	Penn. Salt Mfg. Co.	C	T	S
Michigan	Wyandotte	Wyandotte Chemical Corp.	—	—	S
Nevada	Las Vegas	Stauffer Chemical Co. of Nevada, Inc.	—	—	S
New Hampshire	Berlin	Brown Co.	C	T	S
New Jersey	Deepwater Point	E. I. duPont deNemours & Co., Inc.	—	—	—
New York	Mechanicville	West Vir. Pulp & Paper Co.	—	—	S
New York	Niagara Falls	E. I. duPont deNemours & Co., Inc.	—	—	—
New York	Niagara Falls	Hooker Electrochemical Co.	C	T	S
New York	Niagara Falls	International Minerals & Chem. Corp.	—	—	S
New York	Niagara Falls	Mathieson Chemical Corp.	—	T	S
New York	Niagara Falls	Niagara Alkali Co.	C	T	S
New York	Niagara Falls	Stauffer Chemical Co.	—	—	S
New York	Syracuse	The Solvay Process Div., Allied Chem. & Dye Corp.	C	T	S

Ohio	Ashtabula	National Distillers Chem. Co.	— — S
Ohio	Barberton	Columbia-Southern Chem. Co.	C T S
Ohio	Painesville	Diamond Alkali Co	C T S
Oregon	Portland	Penn. Salt Mfg. Co., Wash.	C T S
Rhode Island	Providence	Fields Point Mfg. Corp.	C — —
Tennessee	Memphis	Velsicol-Corp.	C T S
Texas	Corpus Christi	Columbia-Southern Chem. Corp.	C T S
Texas	Freeport-Velasco	The Dow Chemical Co.	— — S
Texas	Houston	Diamond Alkali Co.	C T S
Texas	Houston	Ethyl Corp.	— — S
Virginia	Hopewell	Hercules Powder Co.	— — S
Virginia	Hopewell	The Solvay Process Div., Allied Chem. & Dye Corp.	C T S
Virginia	Saltville	Mathieson Chemical Corp.	— — S
Washington	Tacoma	Hooker Electrochemical Co.	C T S
Washington	Tacoma	Pennsylvania Salt Mfg. Co. of Washington	C T S
West Virginia	New Martinsville	Columbia-Southern Chem. Corp.	C T S
West Virginia	So. Charleston	Westvaco Chem. Div., Food Machinery & Chem. Corp.	— T S
Wisconsin	Kimberly	Kimberly Clark Corp	— — —

Canadian Producers

Province	City	Producer	Containers Filled*
Ontario	Cornwall	Canadian Industries, Ltd.	— — S
Ontario	Sarnia	Dow Chemical of Canada, Ltd.	C T S
Ontario	Windsor	Canadian Industries, Ltd.	C T S
Quebec	Arvida	Aluminum Co. of Canada, Ltd.	— — S
Quebec	Beauharnois	Dominion Tar & Chem. Co., Ltd.	— — S
Quebec	Shawinigan Falls	Canadian Industries, Ltd.	— — S

Cuban Producers

Province	City	Producer	Containers Filled*
Santa Clara	Sagua la Grance	Electro-Quimica de Sagua	C —

* C—Cylinders; * T—Ton Containers; * S—Single Unit Tank Cars

Repackers of Liquid Chlorine
(Lists Supplied by The Chlorine Institute, Inc.)

State	City	Repackager	Containers Filled*
Alabama	Birmingham	Wittichen Chemical Co.	C —
California	Duarte	Tops Chemical Co.	C T
California	Los Angeles	The Dow Chem. Co., Western Div.	C T
California	Torrance	John Wiley Jones Co., Inc.	C T
Colorado	Denver	Denver Fire Clay Co.	C —
Florida	Jacksonville	Jones Chemicals, Inc.	C T
Florida	Tampa	Tesco Chemicals, Inc.	C T
Georgia	Atlanta	Tesco Chemicals, Inc.	C T
Georgia	Savannah	Coastal Chemical Co.	C —
Illinois	Chicago	Alexander Chemical Co.	C T
Indiana	Beech Grove	John Wiley Jones Co., Inc	C T
Iowa	Burlington	McKesson & Robbins	C —
Missouri	Kansas City	Thompson-Hayward Chem. Co.	C —
New Jersey	Maple Shade	Pioneer Chloramone Corp.	C —
New Jersey	Kearny	Marzahl Chemical Co.	C —
New Jersey	Newark	American Oil & Supply Co.	C —
New Jersey	Newark	E. M. Sergeant Pulp & Chem. Co.	C —
New York	Caledonia	John Wiley Jones Co.	C T
North Carolina	Charlotte	John Wiley Jones Co.	C T
North Carolina	Thomasville	Tesco Chemicals Inc.	C T

Pennsylvania	Altoona	Western Penn. Chem. Co.	C T
Pennsylvania	Lebanon	Lebanon Chem. Co.	C T
Pennsylvania	Philadelphia	Penn. Salt Mfg. Co.	C T
Pennsylvania	Philadelphia	Pioneer Chem. Works, Inc.	C T
South Carolina	Spartanburg	Moreland Chemical Co.	C —
Virginia	Rosslyn	Peebles Chemical Co.	C —
West Virginia	Belle	Belle Alkali Co.	C —
Wisconsin	Milwaukee	Hydrite Chemical Co.	C T

* C—Cylinders; T—Ton Containers

PRODUCERS OF DRY HYPOCHLORITES

State	City	Producer
Michigan	Wyandotte	Pennsylvania Salt Manufacturing Co.
New York	Niagara Falls	Mathieson Chemical Corporation
Ohio	Barberton	Columbia-Southern Chemical Corp.

MANUFACTURERS OF CHLORINATORS AND EQUIPMENT FOR FEEDING HYPOCHLORITES

State	City	Manufacturer	Equipment*
California	Los Angeles	Paddock Pool Equipment Co.	C —
Illinois	Chicago	Everson Manufacturing Co.	C —
Maryland	Baltimore	Mathieson Chemical Corp.	— H
Massachusetts	Somerville	Precision Machine Co.	— H
New Jersey	Newark	Wallace & Tiernan Co., Inc	C H
New York	Buffalo	Manzel Brothers Co.	— H
New York	Buffalo	Wilson Co.	— H
New York	Leroy	Lapp Insulator Co.	— H
New York	New York	Morse Boulger Destructor Co.	— H
Pennsylvania	Hatboro	Fischer & Porter Co.	C —
Pennsylvania	Philadelphia	Milton Roy Co.	— H
Pennsylvania	Philadelphia	Orchem Pump Co.	— H
Rhode Island	Providence	Builders-Providence, Inc.	C —
Rhode Island	Providence	Proportioneers, Inc.	— H
Texas	Dallas	Chlor-O-Matic Manufacturing Co.	— H

* C—Chlorinators H—Equipment for feeding hypochlorites

Sewer Service Charge Proposed in L.A.

Expansion of Treatment Plant Needed: To Cost $3.3 million

A recommendation that a sewer service charge be adopted in Los Angeles on a year's trial basis has been made to the City Council by the Board of Public Works.

After the test period, the board said, the question of continuing the charge should be submitted to the voters. A basic rate of 75 cents a month for residences is proposed by the board in a tentative rate schedule.

Simultaneously, City Engineer Lloyd Aldrich submitted a report saying that a $3,337,000 expansion of Hyperion sewage treatment plant is needed to handle an increased load from a growing population.

He proposed that the plant be enlarged to handle an additional 100,000,000 gallons of sewage a day. The plant is now operating near capacity.

Aldrich said the expansion would take care of the city's needs to 1965 and would reduce the cost of handling sewage from $17 to $14 per 1,000,000 gallons.

A Hank Roesler Cartoon

Leadville, Colo., Has First Sewage Treatment Plant

Designed by Ripple and Howe, Denver consulting engineers, to cope with the rugged weather conditions of its two-mile-high altitude in winter months, Leadville, Colo., has a $200,000 sewer system and sewage treatment plant. The bond issue was passed by voters in 1952.

Part of the sewer lines comprising the new sewerage system were put down in 1880, and are in excellent condition. Sewage has in the past been discharged to a tributary of the Arkansas river. The Leadville plant is the third on the Arkansas river in Colorado, other treatment plants operating at Pueblo and Portland.

Safety in Sewage Works Maintenance and Operation

The Fifth of a Series

by **LEROY VAN KLEECK**, *Prin. San. Engr., Conn. State Dept. of Health Hartford, Conn.*

THE first four installments in this series, comprising Part I, discussed employee safety in sewers. (July, August, September and October issues.) This article reviews special hazards relating to pumping stations which constitute a part of the sewerage system.

Part II

Employee Safety in Sewage Booster Pumping Stations

Section A

Prevention of Physical Injuries

(It will also be useful to review Part I, Employee Safety in Sewers)

Warnings

Warning signs should be prominently displayed as a precaution against any hazards inherent in the design of a station. In an effort to reduce costs, booster sewage pumping stations often are crowded for space. This condition results in hazards such as steep stairs. Projecting objects (such as valve wheels, or space heaters hung from the ceiling) which might cause head injuries, should be painted red to attract attention. A well designed booster pumping station is illustrated in Fig. 1.

Guards

Hatchways to station basements should be kept covered, or a chain with fastening hook attached to posts should be kept in place across them. The moving parts of exposed machinery (belts, flywheels, etc.) should have sturdy metal guard enclosures.

Electrical Equipment

Electrocution is not the least of the potential hazards associated with pumping station operation. Disabling shocks are possible under the right conditions even with low voltages.

Switchboards afford the major hazard from electric shock. Enclosed boards (Fig. 2) are shock proof; open boards (Fig. 3) *are not*. The operator must exercise care in handling switches on open boards, now found mostly in the older stations. A rubber mat should be placed in front of switchboards as an additional safety measure. The feet should be dry when handling the board.

Good grounding of all electrical equipment (switchboards, motors, etc.) is essential.

Bare wires or those on which insulation has become frayed should be properly tapped or the wires replaced.

When there is work to be done on any electrical equipment such as a motor or switch, care must be taken that the unit is disconnected from the current. If the current for the deadened equipment has been killed at the main board only and the equipment is remotely located, a red warning card should be hung on the board as a precaution against another workman throwing the switch.

Heavy motors should be moved by hoists rather than by manpower.

Lighting

Lighting should be ample, whether through natural or artificial means. Rarely do windows alone provide sufficient light for safe working conditions. Electric lamps should be of ample wattage, properly spaced and available in needed locations. Lamps with extension cords should be available, where necessary, to supplement stationary lamps. The lighting system *should be used*—trying to save a few cents worth of electricity may be the cause of a serious physical injury.

Good illumination is aided by the employment of light-colored paints for walls and ceilings.

Ladders

Space limitations often result in the use of vertical ladders as a means of access to pump rooms and wet wells. Their use is to be discouraged in favor of stairs. Even a spiral stairway or ship's ladder is preferable to a vertical ladder.

Vertical ladders whose depth exceeds 10 feet should be equipped with a hoop cage. Although we are not

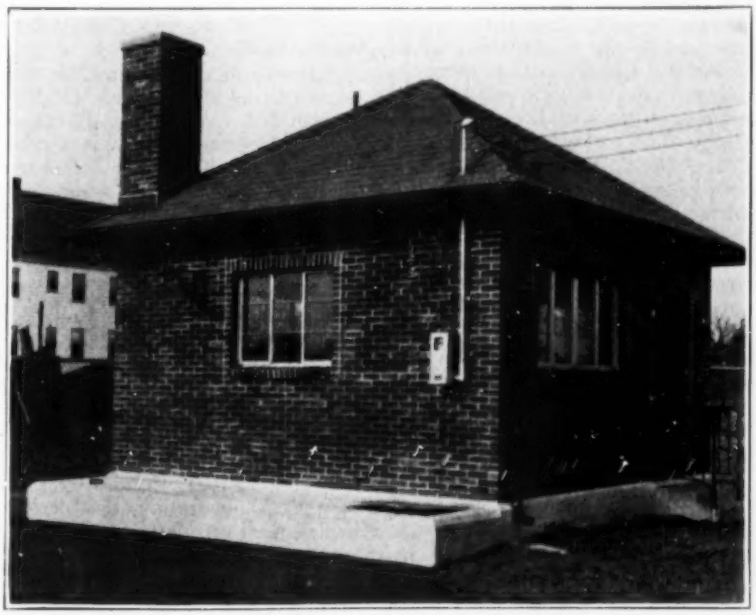


Fig. 1—MODERN sewage booster pumping station
Exterior view showing entrance to wet well through hatchway in left foreground. Interior view of wet well is shown in Fig. 5.

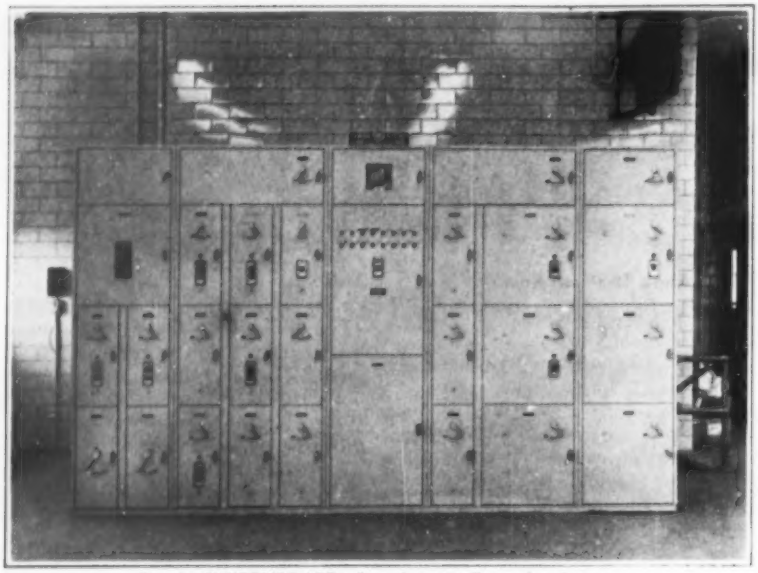


Fig. 2—SWITCHBOARD of modern totally enclosed type
Such boards are shock-proof.

discussing here the details of safety design in sewage works, there are circumstances where unsafe design should be pointed out and corrective measures taken by the operator. Ladder rungs should be kept painted and in good repair. It is highly desirable to have two workmen visit any booster pumping station where vertical ladders have been installed. Then, in the event of a fall, immediate aid is at hand.

Fire Extinguishers

Every booster sewage pumping station should have one or more fire extinguishers of a design and capacity approved by the Underwriter's Laboratories. Either carbon tetrachloride or carbon dioxide extinguishers are safe for use with fires of electrical origin. The extinguishing agents in these extinguishers do not conduct electricity nor do they damage electrical appliances. In small and poorly ventilated areas the danger of asphyxiation must be borne in mind, however, when using these extinguishers, especially the carbon tetrachloride type. For fires other than electrical, the soda ash and acid type of extinguisher is satisfactory.

Not only are fire extinguishers a protection to life but small fires in electrical equipment often can be put out before damage is done to the insulation.

Good Housekeeping

Good housekeeping is a major protection against physical injuries in pumping stations. Tools and portable equipment should be promptly picked up and stored in designated places. All working areas should be kept clear of debris. Floors, ladder rungs and stair treads should be maintained free of oil and grease. Exterior walks should be cleared of ice and snow in winter. Quite apart from safety hazards, good housekeeping invariably reflects good maintenance and operation of the station.

Sufficient Help

As in sewer work, sufficient help under competent supervision for the job at hand is a basic requirement for safe work in pumping stations.

Section B
Prevention of Body Infections

Washing Facilities

A supply of water of potable quality, soap, and paper towels should be furnished in all but small booster sewage pumping stations. It is usually not practical to supply hot water. When washing facilities are not provided, the suggestions given in Part I may be followed.

Cross-Connections

Cross-connections are hazard to the public and to the station attendants. Any physical connection between a potable water supply and piping or equipment carrying sewage or other filth constitutes a cross connection. Check or gate values on the potable water supply line are *not* adequate protection; they frequently leak. Neither should differences in pressure be depended upon, as breaks or interruptions of potable water service may temporarily reverse the pressure balance.

In pumping stations, connections from potable water supplies to water-sealed pump glands must be avoided. Water for sealing may be obtained through use of a float-operated elevated tank supply, with the potable water supply pipe terminating above the maximum water level of the tank. If sufficient pressure cannot be secured by this means, a segregated pumped supply of water may be used. In this case, the water pump obtains its suction from a float-controlled water tank which may hold water from a potable water system. The pump discharge may then be direct to the sewage pump packing glands, or an intermediate pressure tank may be utilized. In some cases, grease seals may be substituted for water seals.

Water ejectors should not be used for emptying pump well pits filled with sewage pump drainage water and other sewage-contaminated liquid. Electrically operated sump pumps should be substituted.

A frequently observed cross connection in pumping stations is that created when flushing water hoses supplied from systems of potable water are left submerged in sewage wet walls. Taps for hoses should be elevated above the maximum flow line of wet wells and the hose left coiled on a reel at a similar elevation. Otherwise back-siphonage of sewage may occur through the water mains as a result of a vacuum condition in the water piping coupled with a leaking shut-off valve.

Personal Precautions

The personal precautions which should be taken by pumping station attendants are quite similar to those recommended for sewer workers. To summarize, the most important precautions are:

1. Keep the hands below one's collar when working in wet walls, packing pumps, etc.
2. Do not smoke while at work.
3. Wash the hands after work and before smoking or eating.
4. Apply a 2% tincture of iodine or a tincture of methiolate to cuts, scratches or other minor wounds.
5. See a doctor *at once* for all major wounds.
6. Have typhoid inoculations.

First-Aid Kits

A first-aid kit should be available in booster sewage pumping stations or one should be carried in the service truck.

Section C
Prevention of Dangers from Noxious Gases or Vapors and from Oxygen Deficiency

Locations of Major Danger

The following constitute locations of major danger:

1. The sewage wet well.
2. The pump and motor rooms, if connected inside the structure with the wet well. (This arrangement is poor practice.)
3. Gasoline engine stand-bys for emergency sewage pumping.

I—Safety Precautions in Wet Wells

Lighting

It is preferable *not* to use permanent lighting fixtures in wet wells because of the corrosive atmosphere. If provided, they should be vapor-proof and explosion-proof fixtures throughout, including the switches. Otherwise, explosion-proof cord-extension lights or portable safety lamps should be used for illumination. For illustrations of poorly and well lighted wet wells, see Figs. 4 and 5.

Keeping Wet Wells Clean

Depending on the design of the wet well, the structure should be hosed frequently enough to prevent the accumulation of septic sludge which may decompose and give off methane or carbon dioxide gas. Wet wells are hosed daily at some stations; others are hosed once a month; a few seem to require cleaning only once or twice a year. The accumulation of solids which occurs must serve as the guide for frequency of cleaning.

Avoiding Sources of Ignition

No sources for ignition of possible flammable gas accumulations should be present in wet walls. Safety lighting has been mentioned. In addition, station attendants working in wet wells should avoid smoking, use no open lights and prevent sparks if raw sewage flow or sludge accumulations are present.

Ventilation

All hatchways to wet wells should be opened wide while men are at work in them. If hatchways have been provided at opposite ends of the well and a wind is blowing, quite effective cross-ventilation may occur. Portable blowers may be utilized in case of need.

In large deep wet wells, especially if serving pumping stations tributary to industrial areas, permanent mechanical ventilation should be provided. This is best accomplished by providing an air inlet near the top of the well (a hatchway will serve for this purpose) and an exhaust duct, connected to an exhaust fan, located just above the maximum water level of the well.

The fan and controls may be located in the pump motor room with fan exhaust through the roof of the pumping station. The fan capacity should be sufficient to effect a complete change of air in the wet well in about 5 minutes, and workmen should not enter the structure until 5 minutes after the fan has been started.

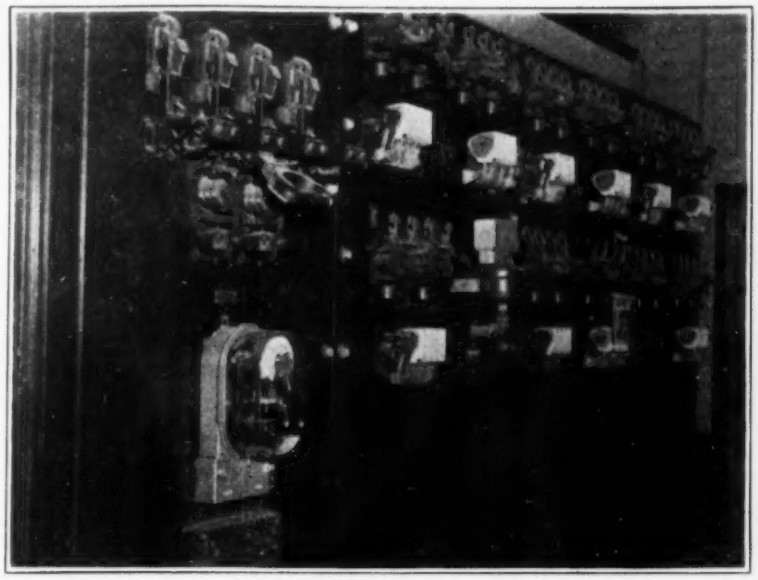


Fig. 3—SWITCHBOARD of old open switch type
Such boards present a shock hazard.

Forced exhaust ventilation for wet wells is particularly recommended where workmen must regularly enter such wells to clean or inspect bar screens or comminutors installed within or adjacent to the well. Natural ventilation or wind-driven exhaust systems (gravity method) on roofs of pumping stations should not be depended upon under such circumstances. As pointed out by Langford*: "Gravity systems obtain the necessary pressure difference by using chimneys or vent flues which become more and more effective as the difference between the outside and inside temperature increases. As long as a temperature difference of not less than 40 degrees between indoors and outdoors exists. These systems can be depended upon for a definite result. *With slight temperature differences, the effectiveness of gravity systems decreases rapidly.*" (Italics by this author.)

Testing for Noxious Gases or Oxygen Deficiency

It is important to remember that any of the noxious gases or vapors which may accumulate in sewers may also be present in pumping station wet wells by means of the open sewer terminating in the wet well. Unless the continuous flow of raw sewage is diverted from the wet well and adequate means for pre-ventilation of wet walls is available, tests for the noxious gases and vapors and oxygen deficiency, as discussed in "Part I, Employee Safety in Sewers," should be made before workmen enter.

II—Safety Precautions in Dry Wells Not Completely Segregated from Wet Wells

In the design of some booster sewage pumping stations, particularly those of older design, the so-called dry well, containing the drive motors, electrical controls, and sewage pumps, is connected with the sewage wet well within one structure. In such cases an outside separate entrance to the wet well is not provided and access to the well is afforded by a connecting room inside the structure or through a trap door in the floor of the dry well. In some cases the wet well and dry well are in one room without even the protection of a dividing wall or door. Stations utilizing sewage-submerged pumps also fall into this class.

Protection against the occurrence of explosions from gasoline vapor or fuel gas discharges may be effectively provided in stations designed with inter-connected dry and wet wells by complying with the following precautions:

1. The dry and wet wells should be sealed off as much as possible from each other by keeping connecting doors closed and tightly fitting. Manhole or hatchway openings in the dry well floor to furnish access to wet wells may be gasketed and tightly fastened to reduce the possibility

* "Safety Considerations in the Design of Gas Utilization Facilities", Leonard L. Langford, Sewage Works Journal, January 1945, Page 66.

Fig. 4—DARK and hazardous wet well
Note steep vertical entrance ladder and wooden platform which eventually will rot.

of gas leakage. Float rod openings for pump controls terminating through the floor of the dry well section of the station may be closed off as much as possible to prevent the escape of gases or vapors.

2. A continuous air intake to the dry well should be provided by open windows or ducts, coupled with a continuous or intermittent mechanical exhaust system drawing from the station floor to the roof of the structure. The exhaust fan can be set to operate for a given number of minutes per hour to maintain a change of air.

3. Explosion-proof motors and electrical equipment should be used. It is also necessary to avoid any other sources of ignition such as open heaters. (These include gas-fired or electrically-operated space heaters, as well as oil-fired or gas-fired boilers. Heat can be safely furnished under such conditions by use of hot water or steam radiators supplied with heat from a fuel-fired boiler located in an adjacent segregated structure or room.)

III—Safety Precautions with Gasoline Engines Used for Stand-By Power

On September 23, 1943 at Teaneck, New Jersey, a sewage booster pumping station was destroyed and the attendant was seriously injured by the ignition of gasoline vapor from a flooded carburetor on a stand-by gas engine.

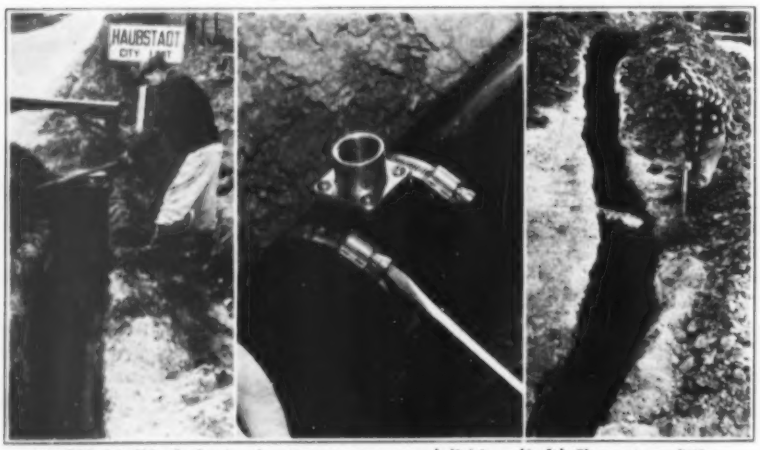
Gas engines having elevated gasoline storage tanks are hazardous if the carburetor float control becomes stuck and allows gasoline to flow on to the pumping station floor. Under such a condition any source of ignition (smoking, throwing on an ordinary light switch, a sparking motor, etc.) may cause a serious explosion.

Precautions against such a disaster should include:

1. A shut-off valve for elevated gasoline storage tanks.
2. Use of a fuel-pump type of engine, if possible, to prevent the continuous discharge of gasoline through a defective carburetor.
3. Installation of explosion-proof fixtures and avoidance of smoking or other sources of ignition upon entering structures containing gasoline engines.
4. Careful observation of the operating floor for gasoline accumulations and odor observations before entering such structures or before using any nonexplosion-proof lights or switches for illumination.
5. Good engine maintenance.

To be continued

Fig. 5—SAFE and well lighted wet well
Note ship's ladder for entrance, the concrete platform, and guide rail. Bar screen is under grating in foreground.



WATER MAIN of plastic pipe to serve a new subdivision. (Left) Flange-type fitting joins 4-inch plastic pipe to the metal line; (center) connection for service line is saddle-type fitting welded with solvent cement and held by metal straps; (right) semi-rigid plastic pipe conforms to curves without angle joints.

Plastic Pipe Water Mains Now in Operation

Water mains of plastic pipe have been installed, at Haubstadt, Indiana, where the city water facilities have been extended to a subdivision more than half a mile from the village through pipe extruded of Tenite butyrate plastic.

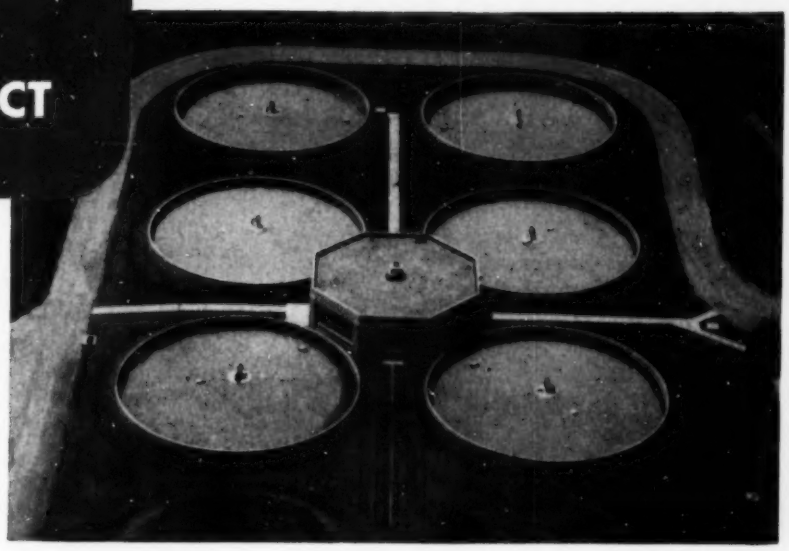
The installation, made by the Dilbeck Realty Co., Evansville, Indiana, required approximately 5000 feet of 4-inch diameter pipe. Water is now being delivered to five houses already built within the thirty-acre subdivision, and forty-five houses will eventually be built and served by the plastic water main.

Advantages claimed for the pipe are: its resistance to corrosion and electrolytic action; quickly made joints with solvent cement and slip-sleeve couplings; and ease of handling due to its unusually light weight. One man can carry three 20-foot lengths without difficulty. The pipe also delivers approximately 40% more water than steel pipe of the same diameter. This is attributed to the smooth interior wall of the plastic pipe as compared to that of steel.

This water main installation is one of the first in butyrate plastic to be made. However, the corrosion-resistant pipe is already employed by the oil industry for conducting sour crude oil and salt water.

ACCELERATED SLUDGE DIGESTION NOW A FACT

*Exclusively through the Catalytic Reduction Process**



CRP

CATALYTIC REDUCTION PROCESS

The Catalytic Reduction Process completes biological sludge digestion in one-third to one-fourth of digester volume generally required. The Process accomplishes this by digesting at solids loading rates three to four times those being practiced. This accelerated digestion is simple and economical, using only the natural products of anaerobic decomposition.

Originating in 1946, the Process was developed, tested and verified over six years on both laboratory and pilot plant scale. The results obtained in the pilot plant operation have been proven in full scale plant operation at the Columbus, Ohio Sewage Treatment Works in 1952 and 1953.

The Catalytic Reduction Process applied to one 70′ tank at the Columbus Plant digested 3.38 times the quantity of sludge solids digested in a similar tank in parallel operation not using the Process. The tank operated under the Process produced a reduction of solids within established ranges, normal gas production and readily driable odorless sludge.

The Catalytic Reduction Process is now available for consideration by consulting engineers for application on plants under design and for plants requiring expansion. The Process when applied to overloaded digesters will provide sufficient capacity without additional tanks.

**The only proven Process for accelerating biological digestion. (Patents applied for.)*

The Catalytic Reduction Process is offered through the Catalytic Reduction Co., Inc. a subsidiary of the Chicago Pump Company.

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SEWAGE EQUIPMENT DIVISION

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Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

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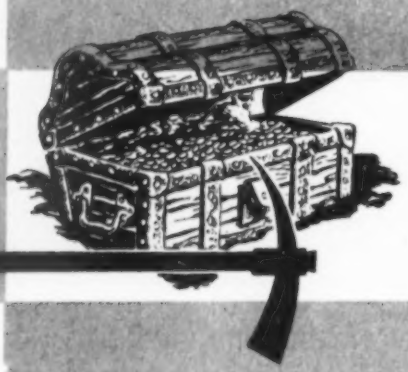
"Buried Treasure"

that is...

if they're WELSBACH-*Kitson*



Not pirate gold or pieces of eight... but that "buried treasure" is the *extra* quality built right into Welsbach-*Kitson* corporation and curb stops. The quality and dependability of Welsbach-*Kitson* products means that you'll have fewer replacement problems... and no costly excavating. They're built to give lasting service and satisfaction. When you install Welsbach-*Kitson* products underground, you'll find that they are really "buried treasure"—but the kind of "buried treasure" you won't want to—or have to—dig up!

No. 1100

No. 1200

for underground installations insist on highest quality... insist on WELSBACH-*Kitson*!

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KITSON VALVE DIVISION

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Meetings Scheduled

Nov. 3—Plymouth, N.H. *(Plymouth Water Works)*
NEW HAMPSHIRE WATER WORKS ASSOCIATION. Sec'y. William A. Healy, 17 Capitol St., Concord, N.H.

Nov. 4-6—Roanoke, Va. *(Hotel Roanoke)*
VIRGINIA SECTION A.W.W.A. Sec'y, J. P. Kavanagh, 915 Colonial-American Bank Bldg., Roanoke, Va.

Nov. 5—East Providence, R.I. *(Wannamoisett Country Club)*
NEW ENGLAND SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, Stephen M. Hurley, Jr., 331 State Office Bldg., Providence, R.I.

Nov. 5-7—Yakima, Wash. *(Hotel Ch'nook)*
PACIFIC NORTHWEST SEWAGE & INDUSTRIAL WASTE ASSOCIATION. Sec'y, Robert O. Sylvester, Univ. of Washington, Seattle, Wash.

Nov. 9-11—High Point, N.C. *(Sheraton Hotel)*
NORTH CAROLINA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, E. C. Hubbard, State Board of Health, Raleigh, N.C.

Nov. 9-11—High Point N.C. *(Sheraton Hotel)*
NORTH CAROLINA SECTION A.W.W.A. Sec'y, E. C. Hubbard, State Board of Health, Raleigh, N.C.

Nov. 9-13—New York, N.Y. *(Statler & New Yorker)*
AMERICAN PUBLIC HEALTH ASSOCIATION, Sec'y, Mrs. W. R. Walsh, A.P.H.A., 1790 Broadway, New York, N.Y.

Nov. 12-13—Lincoln, Neb. *(Hotel Capitol)*
NEBRASKA SEWAGE & INDUSTRIAL WASTE ASSOCIATION. Sec'y, Paul W. Mousel, 602 W. B. Street, McCook, Neb.

Nov. 16-20—Stillwater, Okla. *(Okla. A. & M. College)*
OKLAHOMA WATER, SEWAGE & IND. WASTES SHORT COURSE. Sec'y, H. J. Darcey, State Dept. of Health, Oklahoma City, Okla.

Nov. 19—Boston, Mass. *(Statler Hotel)*
NEW ENGLAND WATER WORKS ASSOCIATION. Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Nov. 20—Harrisburg, Pa. *(Penn Harris Hotel)*
PENNSYLVANIA CLEAN STREAMS CONFERENCE. (Sponsored by Penna. State Chamber of Commerce.) Sec'y, R. V. Wall, State Chamber Bldg., Harrisburg, Pa.

Dec. 3-5—Havana, Cuba
CUBAN SECTION A.W.W.A. Sec'y, L. H. Daniel, Baratello 9, Havana, Cuba

Dec. 9—Waterville, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St, Winthrop, Me.

Dec. 13-16—St. Louis, Mo.
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. (Annual Meeting.) Sec'y, E. G. Van Antwerpen, 120 East 41st St., New York 17, N.Y.)

Dec. 17—Boston, Mass. *(Statler Hotel)*
NEW ENGLAND WATER WORKS ASSOCIATION. Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

(Continued on page 82A)

CONCRETE PIPE

Gives You Strong, Durable, Economical Sewers

Leading sanitary engineers specify concrete pipe for sewers because it offers:

1. **GREAT STRENGTH** to sustain heavy overburdens, to resist severe impact and to withstand the wearing action of tough climatic or soil conditions.
2. **MAXIMUM CAPACITY** due to its smooth interior finish and clean, even joints.
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Cast iron pipe centrifugally cast and with mechanical joints is the most efficient and economical means of modern day distribution. Serving the industry with Super de Lavaud cast iron pipe centrifugally cast in modern long lengths with standardized Mechanical Joints, Bell and Spigot or Flanged, with or without centrifugally applied cement lining. Rugged, dependable and economical.

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Cable Drum Clutch
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OK CHAMPION
Power Sewer
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Twin rigs take debris from sewer to street in one operation.
Mounted on four wheel trucks—safer—eliminates lifting over or pulling away from manholes—safer tandem towing.
All Controls at Working End—keeps operator out of passing traffic—allows full vision of work.
Built-in Gear Reduction Ratio—allows better use of power for bucket travel.
Fully Automatic Safety Clutch—instant acting—avoids damage to tiles and machines.

Rely on the pioneer manufacturer of power sewer cleaners.

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Champion Corporation, 4700 Sheffield Ave., Hammond, Indiana
Please send information on new OK Champion Power Sewer Cleaners.

Name.....Title.....

Address.....

(*Continued from page* 80A)

Jan. 19, 1954—New York, N.Y. *(Hotel Commodore)*
NEW YORK SECTION A.W.W.A. (Winter Luncheon Meeting). Sec'y, Kimball Blanchard, 50 West 50th Street, New York, N.Y.

Jan. 21-22—New York, N.Y. *(Hotel Belmont Plaza)*
NEW YORK SEWAGE & INDUSTRIAL WASTES ASSOCIATION. 21 No. Broadway, White Plains, N.Y.

Jan. 21—Boston, Mass. *(Statler Hotel)*
NEW ENGLAND WATER WORKS ASSOCIATION. (Monthly Meeting). Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Feb. 9-10—Portland, Me.
MAINE WATER UTILITIES ASSOCIATION. (Annual Meeting). Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Feb. 10-12—Indianapolis, Ind. *(Lincoln Hotel)*
INDIANA SECTION A.W.W.A. Sec'y, Geo. G. Fassnacht, 1330 W. Michigan St., Indianapolis 7, Ind.

Feb. 18—Boston, Mass. *(Statler Hotel)*
NEW ENGLAND WATER WORKS ASSOCIATION. (Monthly Meeting).

Mar. 17-19—Chicago, Ill. *(LaSalle Hotel)*
ILLINOIS SECTION A.W.W.A. Ssc'y, Dewey W. Johnson, 122 So. Michigan Ave., Chicago, Ill.

Mar. 18—Boston, Mass. *(Statler Hotel)*
NEW ENGLAND SECTION A.W.W.A. Sec'y, Geo. G. Bogren, 14 Beacon St., Boston 8, Mass.

Mar. 18—Boston, Mass. *(Statler Hotel)*
NEW ENGLAND WATER WORKS ASSOCIATION. (Monthly Meeting). Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Apr. 7-9—Emporia, Kan. *(Broadview Hotel)*
KANSAS SECTION A.W.W.A. Sec'y, Harry W. Badley, 119 West Cloud, Salina, Kan.

Apr. 12-14—Toronto, Ont. *(Royal York Hotel)*
CANADIAN SECTION A.W.W.A. Sec'y, A. E. Berry, Ontario Dept. of Health, Toronto, Ont.

Apr. 14—Norway, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Apr. 22-23—Watertown, N.Y. *(Woodruff Hotel)*
NEW YORK SECTION A.W.W.A. Annual Spring Meeting. Registration evening of 21st). Sec'y, Kimball Blanchard, 50 West 50th Street, New York, N.Y.

Apr. 22-23—Lincoln, Neb. *(Cornhusker Hotel)*
NEBRASKA SECTION A.W.W.A. Sec'y, E. Bruce Meier, University of Nebraska, Lincoln, Neb.

Apr. 22-24—Tucson, Ariz.
ARIZONA SECTION A.W.W.A. Sec'y, M. V. Ellis, Supervisor Sewage Treatment Plant, Phoenix, Ariz.

Apr. 24-25—Bozeman, Mont. *(Baxter Hotel)*
MONTANA SECTION A.W.W.A Sec'y, A. W. Clarkson, State Board of Health, Helena, Mont.

May 23-28—Seattle, Wash. *(Exhibits and Technical Sessions—Auditorium)*
AMERICAN WATER WORKS ASSOCIATION (74th Annual Convention). Exec.-Sec'y, Harry E. Jordan, 521 Fifth Ave., New York 17, N.Y.
(Reservations Announcement by Nov. 1st).

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LEARNED FROM EXPERIENCE

C-P-P* meets the BIG 3 REQUIREMENTS

The Louisville Water Company picked Concrete Pressure Pipe for a new four-mile, 60-inch line because they want *Sustained High Carrying Capacity*.

Their decision was based on *experience* . . . their own.

While planning this line, they checked on the carrying capacity of earlier Louisville pipe . . . found two supply lines laid within two years of each other some twenty years ago . . . one concrete, the other not.

The concrete line's capacity is now 530,000 gallons-per-day more than when it was laid ("c" value *increased* from 145 to 149). The other line's capacity is 5,480,000 *less* ("c" value is down from 135 to 94).

That's the story in a nutshell, but . . .

This is only one of the reasons why the Louisville Water Company picked Price Pipe. Louisville has other reasons. Price Pipe's *long life*, for example. With Concrete Pressure Pipe, only concrete is exposed . . . and when buried in the ground, concrete is ageless as limestone . . . its life is measured in centuries.

And Louisville likes the *high strength* of Price Pipe. They know it's safe from external loads . . . that sudden and complete failure is all but impossible.

Finally, they like the *economy* of Price Pipe . . . for it gives them "Longest trouble free service at lowest cost" . . . because of its sustained capacity, long life and high strength, and because it is easy to lay, easy to tap, and easy to maintain.

Send for the facts on Price Pipe. Learn how your water lines can have long life, great strength *and* sustained high carrying capacity. Mail the coupon today.

* only CONCRETE PRESSURE PIPE MEETS THE **BIG 3 REQUIREMENTS**

1. Long Life
2. Great Strength
3. Sustained Capacity

PRICE Pressure PIPE
PRESTRESSED CONCRETE
STEEL-CYLINDER PIPE

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Please send me, without obligation, the following literature:

- ☐ Check Sheet of Water Line Requirements
- ☐ Facts on Prestressed Pipe
- ☐ Price Pipe for Pressure Sewer Lines

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Tailored to the needs of any capacity plant by

BLOWER *Specialists*

ROTARY

CENTRIFUGAL

One important reason for the wide popularity of Roots-Connersville Blowers for sewage treatment work is their versatility. For instance:

TYPES . . . either Rotary Positive or Centrifugal—the only blowers that give you this *dual choice.*

CAPACITIES . . . from 10 cfm to 100,000 cfm or higher.

DRIVES . . . electric motor in any desired arrangement; gas engine, burning gas, sewage gas or gasoline.

Thus, your selection of blowers is practically unlimited when you consult the R-C specialists. Whether for industrial waste, or for a village or a metropolitan community, you can standardize on R-C equipment. If growth necessitates larger capacity, even after many years, you can add more R-C Blowers as needed, with the same assurance of continued satisfaction and reliability.

Almost a century of experience in building air- and gas-handling equipment, exclusively, is at your call on your blower applications.

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Exclusive Specialists in Handling Gas and Air

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Search for Communists Reaches Water Works

According to a press report, the California Senate Un-American Activities Committee has announced a full-scale public investigation of alleged Communist infiltration into "critical area" public utility operations, both in San Francisco and in Los Angeles.

The announcement came at the end of a closed-door preliminary hearing by the committee under the chairmanship of Sen. Hugh Burns of Fresno.

Burns said his committee will investigate the alleged infiltration of Communists into water and power projects and transportation and communications operations.

Morris Pledges Cooperation

When informed of Sen. Burns' announcement, Samuel B. Morris, general manager of The Los Angeles Dept. of Water and Power declared:

"To the best of our knowledge, there is no Communist activity in this department. We will be glad to extend full cooperation to the legislative committee in its projected hearing in Southern California and to make available all information to help in its efforts."

Garbage Grinders Increase Family Water Needs by Only 1%

Modern home garbage grinders increase water usage in the average family less than one per cent, it is indicated by a study recently completed by Prof. Kenneth W. Cosens of Ohio State University's department of civil engineering. He used four typical families as his "guinea pigs" in the study, equipping the grinder portion of the waste disposal in their homes with separate meters to record the flow of water when the grinders were in operation.

It was found that, over a period of one year, the amount of water passing through the grinder averaged one and a sixth gallons per person per day. Compared with the national average water consumption of 127 gallons per person per day,

(Continued on page 86A)

Proved through the years

Time is the test of dependability. Behind Nialk Chemicals are more than fifty years of experience in meeting strict specifications.

a typical example...

NIALK LIQUID CHLORINE: When it comes to liquid chlorine, quality can be a matter of life or death. For this is the chemical most commonly used to purify drinking water and dispose of sewage.

That's why NIALK Liquid Chlorine—the first to be produced in commercial quantities—has for many years been the choice of municipal water-supply and sanitation engineers.

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LIQUID CHLORINE
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Give yourself the

Unbeatable Performance of the RIDGID Heavy-Duty Pipe Wrench

If this Housing ever Breaks or Distorts we will replace it Free
HEAVY DUTY
14
RIDGID
"RIDGID" means most service for your money!

Every RIDGID Wrench Factory-Tested

That's what makes sure that every RIDGID performs as you've learned to expect... *every* part inspected, *every* wrench pipe tested 100%! Only RIDGID's housing is unconditionally guaranteed, saving you bother and expense. Full-floating hookjaw, adjusting nut spins easily in all sizes, 6" to 60"; replaceable alloy jaws, handy pipe scale on hookjaw, comfort-grip I-beam handle. For most service for your money, buy RIDGID's . . . at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO, U.S.A.

RIDGID
Work-Saver Pipe Tools

(Continued from page 84A)

the amount used per person by the disposals in the test homes equalled 0.9 per cent of the total average consumption. Cooperating with Prof. Cosens in the study was the Buffalo Water Meter Co. and several manufacturers of waste food grinders.

New Eagle Rock Reservoir Brings Colorado River Water to Los Angeles

A major connection between the municipal Water System of the Los Angeles Department of Water and Power and the Colorado River Aqueduct supply lines of the Metropolitan Water District was completed recently when Colorado River water was turned into the new 85,000,000 gallon Eagle Rock Reservoir and a six-mile section of the 68-inch diameter Eagle Rock-Hollywood Conduit.

The facilities were built under contract by the Department of Water and Power, of which Samuel B. Morris is general manager and chief engineer, and Burton S. Grant is chief engineer of water works.

Designed to regulate the flow of water from the Colorado River feeder lines into the city's water distribution system, the reservoir and appurtenant tunnels were constructed at a contract price of $1,380,702 by the Kemper Construction Co., after Department forces had completed preparation of the site and preliminary construction. Work began on the reservoir in 1950, and the first section of the pipeline was started in 1952.

Completion of the Eagle Rock Reservoir and the first section of the Eagle Rock-Hollywood Conduit makes available additional large quantities of Colorado River water sufficient to meet Los Angeles' needs far into the future.

Los Angeles has used Colorado River water since 1941 to augment existing supplies and the city's future growth is dependent upon the increased use of Colorado River water.

Acid Mine Wastes Studied At Johns Hopkins Univ.

A group of research workers at Johns Hopkins University is making a study of a major stream pollution problem, involving the annual seepage of billions of gallons of acid from certain types of coal mines into rivers. The Interstate Commission

(Continued on page 88A)

AMERICAN DOUBLE-X Mechanical Joint Pipe

For quick laying, superior quality and tight joints, specify American Double-X Mechanical Joint Pipe. "American Double-X" is regular Mono-Cast centrifugal pipe equipped with the standardized mechanical joint for cast iron pipe. The American Double-X joint is the original standardized mechanical joint which was put on the market in 1929.

Manufactured under rigid specifications in diameters 3" through 48", American Double-X pipe will stand the impact of heavy loads and gives complete job satisfaction. American Double-X pipe is conveying water, gas, crude oil, gasoline, sour naphtha, sewage, salt brine—and in fact, just about everything that a pipe line can conceivably convey. It is conveying these products under operating pressures ranging from a few pounds to the square inch, up to pressures in excess of 100 pounds gas and 500 pounds liquid.

Write for American Double-X pipe booklet. A free copy will be sent on request.

AMERICAN CAST IRON PIPE COMPANY

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American Cast Iron Pipe Company,
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Gentlemen: Please send me a free copy of your new illustrated booklet, *"American Double-X Mechanical Joint Pipe."*

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Company .....

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City ..... State .....

(Continued from page 86A)

on the Potomac River Basin is sponsor of the inquiry.

The investigators working under a fellowship have obtained data in the Potomac River Basin indicating that a chemical agent unites with air, water and the mineral pyrite within pyrite-bearing coal mines to produce each year a vast quantity of sulphuric acid.

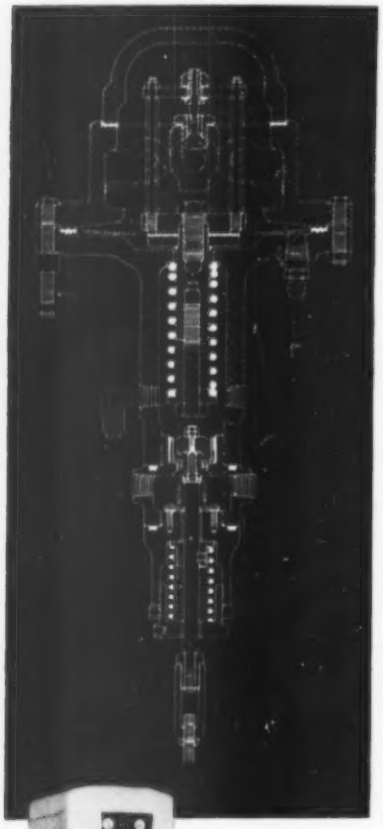
The key to this puzzle apparently consists of a common chemical, in the opinion of the Johns Hopkins research workers. They suggest that a minute quantity of this chemical can set off a chain reaction that produces ferric hydroxide and sulphuric acid. When the two reach streams, the ferric hydroxide disappears but the contaminating sulphuric acid remains.

Curb on Federal Pollution Urged by Engineers

The federal government was recently chided on its failure to follow the example of state and local authorities in the treatment of sewage flowing into the waters around New York.

In a resolution sent to Senators and Representatives from the state, the New York Chapter of the New York State Society of Professional Engineers urged them to "initiate, advocate, support or otherwise provide that appropriations be made for the construction of sewage treatment plants or other necessary control works to abate pollution."

Offending installations cited by the engineers are the United States Military Academy at West Point, Fort Jay, Governors Island and Ellis, Hoffman and Swinburne Islands.



When users of Builders Chlorinizer tell us (and they often do!) that they never before have worked with such a trouble-free, maintenance-free chlorine gas feeder, we tell them we're pleased — but not surprised — to hear this. You see, there *is* a difference in chlorine gas feeders and basic design makes that difference. For instance, Builders Chlorinizer employs a tantalum diaphragm valve which controls chlorine gas in the dry, non-corrosive state. This valve — the "heart" of the Chlorinizer — is a basic design feature of the Chlorinizer and one of the important reasons why Chlorinizer gives such safe, dependable, low-maintenance operation.

Basic Design makes the Difference

For full details on Builders Chlorinizer, write for Bulletins 840-F1B, 840-J30, 840-J8.

Builders-Providence, Inc. 350 Harris Ave., Providence 1, Rhode Island

BUILDERS

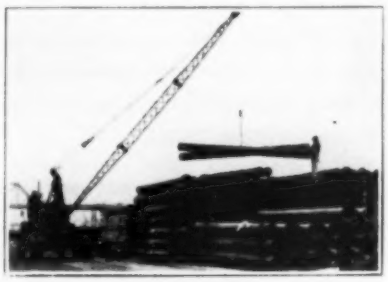
(DIVISION OF B-I-F INDUSTRIES)

Manufacturers & Equipment News

Borchers Appointed Sales Manager for Bristol

The Bristol Company, Waterbury, Conn., has announced the appointment of F. W. Borchers as General Sales Manager of the company.

Mr. Borchers joined the sales organization in 1922 and in 1933 was appointed district manager of the company's Birmingham office. In 1935 he became district manager of the Philadelphia office and in 1946 district manager of the New York office. In 1948 he was appointed assistant sales manager.



Highly-Mobile Truck-Crane

1101

Pitman Manufacturing Co., Kansas City, Missouri, has developed a new highly-mobile truck-crane, designated as the Pitman Crane Model 80.

Capacity up to four tons on a 25-foot boom, with additional boom length up to 59 feet, are features of the new crane, which is designed for

(Continued on page 90A)

Freezing Losses Reduced by the SIMPLICITY of FROST BOTTOM AMERICAN METERS

● A freeze-up can mean costly shop repairs or a minor "on-the-spot" change. American Frost Bottom Meters have a simple patented construction that permits the bottom casing to break by tension and relieve the internal pressure in the event of a serious freeze-up.

All the more delicate—most costly parts—including the gear train—are protected. The breaking pressure is pre-tested at the factory. Hundreds of thousands of meters in service are proof of the effectiveness of this design.

Ask for complete data.

BUFFALO METER CO.

2909 MAIN STREET, BUFFALO 14, NEW YORK

(Continued from page 88A)

installation on trucks 2½ tons or larger.

Precision operation, ability to use the truck it is mounted on for more than a single purpose, quick set-up time, ease of control—these are additional features of the new Pitman crane.

Key to the precision operation of the crane is versatile loadline winch which can be operated either power-up and power-down or free-spooling. This allows the operator either to let the load down under full power or to slip it down as fast as he wants with a foot brake.

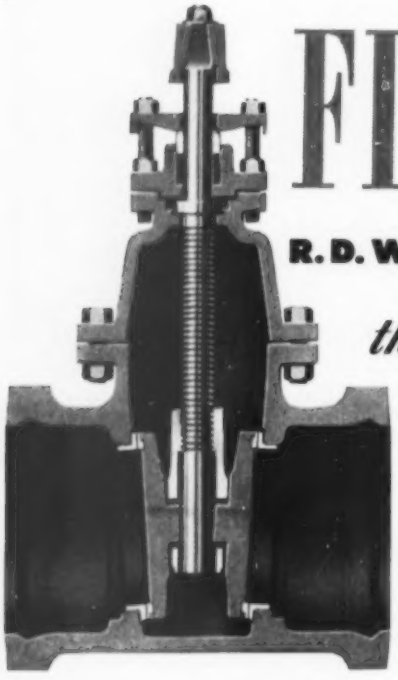
Precise boom action is afforded by (1) a power-up and power-down topping winch, which raises and lowers the boom, and (2) a double-acting hydraulic cylinder which swings the boom in a 180-degree arc. Maximum capacity loads can be topped with the boom.

E. D. West Appointed Sales Manager of Climax Engine

Climax Engine and Pump Manufacturing Division of Eversharp, Inc., has announced the appointment of Mr. E. D. West as General Sales Manager, with headquarters in Chicago. Mr. West has been associated with Climax for 19 years as a sales executive.

Two additional appointments were also announced: Mr. Fred W. Neubauer who has been with Climax for 35 years, has been appointed Plant Manager of its Climax Manufacturing Division located at Clinton, Iowa. Mr. Ted Skeen, District Manager with headquarters in Dallas, Texas, will be in charge of Sales and Service throughout the midcontinent area. Mr. Skeen is well known throughout the southwest and has been with the company in an executive sales capacity for the past seven years.

Mr. E. J. Anselman, the former General Manager, has resigned.



FIRST *choice*

R. D. WOOD GATE VALVES

they LAST

R. D. Wood Gate Valves are first choice with waterworks engineers because they are built to last . . . and last . . . and last. Made from seasoned castings, fully bronze mounted. Their simplicity of design gives generations of trouble-free operation.

Only three moving parts—the spreader and two discs. In opening, the discs are lifted into the bonnet clear of the seats. In closing, they are wedged into place without distortion. Working pressure up to 175 lb. Tested to 300 lb. Rigidly inspected. Conform to AWWA specifications. Supplied with bell, flanged or mechanical joint pipe connections.

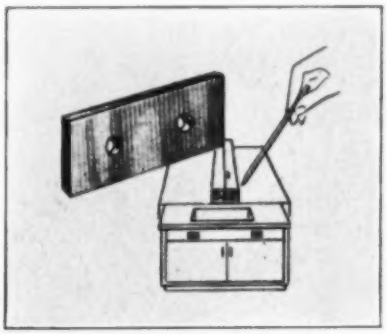
150th anniversary

R.D.Wood

COMPANY

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers of Mathews Hydrants and "Sand-Spun" Pipe (centrifugally cast in sand molds)



Faucet-Panel Solves Problem of Sink In Unitized "Island" Assemblies

1102

Fisher Scientific Company, Pittsburgh, Pa., has developed a faucet-panel that permits a modular sink to be placed flush against adjoining units in an island assembly.

Previously, of course, the splash-backs and reagent shelves of adjoining units would make a gap over the sink, while the sink's own splash-back-and-reagent-shelf prevented the sink from being placed flush against the other units.

The faucet-panel, a little birch panel-and-splashback which accommodates a double faucet, permits a tight fit, making it hard to believe that the island-sink assembly was not designed and manufactured especially for the particular laboratory installation.

American-Marietta Acquires Universal Concrete Pipe Co.

American-Marietta, Chicago, Ill. has announced the acquisition of controlling interest in the Universal Concrete Pipe Company of Columbus, Ohio.

Universal became a subsidiary of American-Marietta Company through

(Continued on page 92A)

You Can't Beat Steel Pipe for Strength

Bethlehem Tar-Enameled Steel Pipe is widely used for water and sewage service because of its resilience, resistance to shock and corrosion, and leakproof joints. But the most important reason for its popularity is its great strength, which is evident in the chart below.

The chart shows the theoretical working and bursting pressures for various pipe diameters and thicknesses. The pressures shown are based upon the use of steel conforming to ASTM Specification A-283, Grade B, having a minimum ultimate tensile strength of 50,000 psi. When exceptionally severe working pressures are encountered, the use of higher strength steel is recommended for greater economy. The nearest Bethlehem office will be pleased to supply complete information.

THEORETICAL INTERNAL PRESSURES OF STEEL PIPE

	1/4 in.			5/16 in.			3/8 in.			7/16 in.			1/2 in.		
DIAM ID	WT LB/FT	MAX WRK PRESS PSI	MIN BURST PRESS PSI	WT LB/FT	MAX WRK PRESS PSI	MIN BURST PRESS PSI	WT LB/FT	MAX WORK PRESS PSI	MIN BURST PRESS PSI	WT LB/FT	MAX WORK PRESS PSI	MIN BURST PRESS PSI	WT LB/FT	MAX WORK PRESS PSI	MIN BURST PRESS PSI
22	63	365	1135	78	465	1420	93	550	1700	109	640	1985	124	730	2270
24	69	335	1040	86	420	1300	102	505	1560	119	585	1820	136	665	2080
30	86	270	835	108	340	1040	129	405	1250	150	475	1455	170	535	1670
36	106	225	695	130	280	870	155	340	1040	181	395	1210	206	445	1390
42	119	195	595	148	240	745	177	285	890	206	335	1040	234	380	1190
48	137	170	520	171	210	650	203	250	780	236	290	910	268	330	1040
54				192	190	580	230	225	695	267	260	810	303	295	925
60				214	170	525	255	200	625	296	235	730	336	265	835
72							309	170	520	359	195	605	408	220	695
84							357	145	450	412	170	520	470	190	595
96	The recommended minimum wall thickness is approximately the pipe diameter divided by 165. Pipe having this diameter-thickness ratio, when backfilled and properly tamped, will withstand any depth of cover. For buried pipe, the recommended minimum thicknesses are shown immediately above heavy black line.									470	145	455	539	165	520
108													611	150	465
120													669	135	415

$P = \frac{t \times T_s}{r}$

P = internal pressure, psi
t = thickness, in.
T_s = allowable unit stress = 60% x 27,000 (yield point) = 16,000 psi
r = radius of pipe, in.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM *Tar-Enameled* STEEL PIPE

(Continued from page 90A)

a favorable arrangement extending payment over a period of years.

Universal, with a total of twenty-six strategically located plants producing concrete pipe and other products, gives further diversification to American-Marietta's activities and establishes them as the country's largest and leading manufacturer of concrete pipe.

Carlon Opens New Plant in Oregon

Carlon Products Corporation, Cleveland, Ohio has announced the establishment of facilities for the manufacture of plastic pipe and fittings in the far west. The new plant is situated in Klamath Falls, Oregon, and will provide rapid and economical delivery of Carlon pipe to distributors throughout the Northwest.

Mr. Philip Britton, Vice President and spokesman for Carlon announced the appointment of Mr. Floyd Wilson to managership of the new Carlon division.

The Klamath Falls Plant brings to 7 the number of plants Carlon has established throughout the United States. Another Carlon plant in Acton, Ontario supplies the Canadian market. The newly established Klamath Falls Plant is another part of the planned expansion program designed to place Carlon manufacturing facilities in strategic locations throughout the entire country.

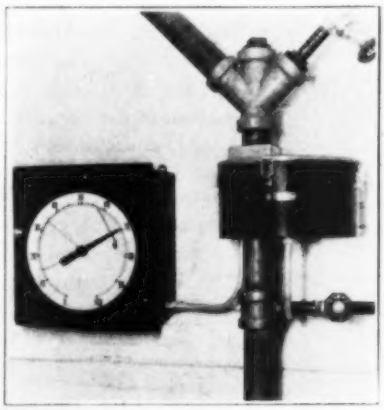
FLEXIBLE BOLTED CONNECTION

Savings in joint making time and labor costs, plus leak-proof flexibility, all combine to increase the demand for M & H Gate Valves with Mechanical Joint end connections. M & H Mechanical Joints are made in accordance with A. S. A. standard specifications A21.11, 1952, with glands, gaskets and bolts interchangeable with Standardized Mechanical Joints for cast iron pipe as furnished by all pipe companies who are members of the Cast Iron Pipe Research Association.

This joint uses the stuffing box principle, by which a thick gasket of triangular cross section is compressed into a stuffing box by a bolted follower ring or gland. Mechanical joint making in the field does not require skilled workmen. The joint's flexibility permits deflection in any direction, longitudinal expansion or contraction without leakage.

Mechanical Joint ends are available on all types of M & H Gate Valves, manufactured in accordance with American Water Works Association specifications, sizes 2 to 36 inches. For complete information, write or wire M & H VALVE AND FITTINGS COMPANY, Anniston, Alabama.

M&H PRODUCTS FOR WATER WORKS • FILTER PLANTS INDUSTRY • SEWAGE DISPOSAL AND FIRE PROTECTION



Automatic Recording Turbidimeter

1103

General Electric Company's Special Products Section, Schenectady, N.Y., has announced a new recording turbidimeter, which continuously and automatically measures and permanently records the number of particles suspended in liquids.

Developed by the company's General Engineering Laboratory for use in any process where turbidity is a significant factor, the G-E device can be used with an audible or visible alarm. It provides readily available turbidity measurements for monitoring and controlling. Adjustable over a wide turbidity range, the turbidimeter has a splash-proof construction and semi-null-balance system.

The theory of operation is that if a liquid has no suspended particles, all light is transmitted while none is scattered so that the ratio of scattered to transmitted light is zero. As turbidity increases more light is scattered, less transmitted, and the ratio increases. The turbidimeter's detecting element is a single photovoltaic cell with current output proportional to the amount of light falling upon it. The light ratio is determined by computing the voltage output of the photo cell when scattered light and then transmitted light are successively incident upon it.

Coagulation Automatically Controlled by New System

1104

The Foxboro Co., Foxboro, Mass., has developed a system of continuous, automatic control of chemical feed-

(Continued on page 94A)

into the rocky soil
of New England
goes

"Century"®

asbestos-cement pipe

Because "Century" pipe is so easy to handle and assemble, the laying crew works right on the heels of the "digger".

This is typical of certain of the hard, rock-filled soil around South Hadley Falls, Mass., in which "Century" pipe was laid. Engineers: Tighe & Bond, Holyoke, Mass.; Contractor: Ted Ondrick, Chicopee Falls, Mass.

One of the latest installations of "Century" asbestos-cement pressure pipe is at South Hadley Falls, Mass. As with other "Century" installations in rocky New England soil—"the digging was tough, but the laying was easy."

Quick and easy laying is just one of the important advantages of "Century" pipe and its Simplex Couplings. Being made from asbestos fiber and portland cement, it cannot rust or tuberculate. It will carry its rated flow at normal pressure for years and years, keeping pumping costs low.

This durable, economical pipe has served American communities for years, and its use increases each succeeding year. Before *your* community contracts for its next water main, you might like to know more about "Century" asbestos-cement pipe. We shall gladly send you complete information.

Free Booklet "Mains Without Maintenance" gives valuable data, specifications, and reference material for anyone interested in water main pipes. Write for your copy now.

Nature made asbestos . . .
Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

(Continued from page 92A)

ers that permits maximum efficiency in chemical coagulation. The system, operated entirely under instrument control, creates and maintains ideal coagulation conditions independent of flow and pH changes in the influent; makes more effective use of chemicals; and improves water clarity and length of filter runs.

Coagulation is controlled by two instruments: a feeder controller which operates the alum feeder in relation to the primary flow; and a pH controller which varies the operating rate of the lime feeder to maintain a predetermined pH range in the flocculation basin.

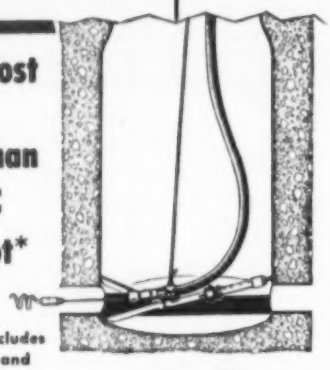
The function of the feeder controller is to operate the alum feeder in response to the variations in water flow and to vary the alum feed rate so that a constant dosage is maintained.

In controlling the pH, the proper pH zone for the character of the water to be treated is first determined. Set to this point, the pH controller receives continuous measurements from the pH electrodes in the flocculation basin and varies the rate of the lime feeder to keep the pH constant.

DO YOU REALIZE?
ONE "FLEXIBLE" SEWERODER

CLEANS 50 BLOCKS OF SEWERS PER WEEK!

At a Cost of Less Than 2¢ a Foot*



*This figure includes maintenance and parts replacement.

SEWERODER

—Is a mechanical marvel that does all rodding with two men—eliminating 9/10ths of the usual hard labor in a day's work. It's increased, low cost capacity permits "preventative maintenance" to be carried on inexpensively—and eliminates costly emergency work. Rod reel contains 900 feet of rods for instant use. Imparts a rotating action to rods and tools. Truck mount models also available.

WRITE today

Flexible SEWER-ROD EQUIPMENT CO.

9059 VENICE BOULEVARD, LOS ANGELES 34, CALIF.

41 Greenway St. — Hamden 14, Conn.
147 Hillside Terrace — Irvington, N. J.
P. O. Box 465 — Memphis, Tennessee
1115 Delaware Ave. — Fort Pierce, Fla.
141 W. Jackson Blvd. — Chicago, Ill.
200 Magee Bldg. — Pittsburgh, Penn.
66 Kinlry Drive — Rochester 9, New York
29 Cordan Avenue — Roslindale 31, Mass.
801 E. Excelsior Blvd. — Hopkins, Minn.
3786 Durango St. — Los Angeles 34, Calif.
4455 S.E. 24th Street — Portland, Oregon
351 West Jefferson Blvd. — Dallas, Texas
Francis Hankin — Montreal & Toronto, Canada

AMERICA'S LARGEST MANUFACTURER OF PIPE CLEANING TOOLS AND EQUIPMENT

Rensselaer Valve Elects President and Will Expand

Rensselaer Valve Co., of Troy, N. Y. will expand its facilities for producing large water works valves, according to Lyman C. Thunfors, newly elected president of the firm.

He made the announcement following the sale of Rensselaer by Neptune Meter Co., to a New York and Ohio investment group.

Thunfors, who was vice president and general manager of Rensselaer when it was a subsidiary of Neptune, said his firm will continue to make and distribute valves and hydrants for the water works field. Production and sales forces will remain unchanged, he added.

Thunfors, a native of Muskegon, Mich., prior to joining Rensselaer in 1949, was vice president for production at the Richmond Radiator Co., Uniontown, Pa., which he joined in 1944. Prior to that he was assistant factory manager at Caterpillar Tractor Co., in Peoria, Ill., from 1930 to 1944.

Thunfors announced the appointment of other officers of Rensselaer now operating as an independent firm. They are: John Hennessy of Albany, vice president and treasurer; Eric Rutledge of Troy, vice president, sales; Myron Early of Troy, vice president, production; Charles H. Forster of Troy, secretary; and H. M. Ferris of Troy, assistant secretary.

The investment group of New York and Ohio business men which acquired Rensselaer from Neptune consists of David Berdon and Jay Levine of New York, Louis Goldsmith and Joseph Karp of Cincinnati and Thomas L. Kaplin of Toledo.

Atlas Mineral Announces New Plastic Pipe

1105

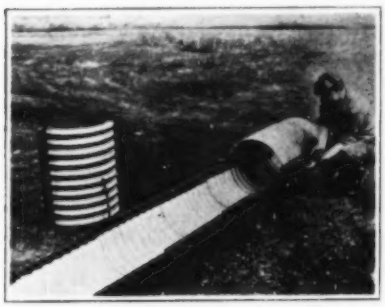
Atlas Mineral Products Co., Mertztown, Pa., has announced that as an addition to its standard line of Ampcolite, high impact styrene pipe, and Ampcoflex, rigid polyvinyl chloride structures, it now has available a high chemical resistant, high impact rigid

polyvinyl chloride pipe and fittings. Polyvinyl chloride pipe is available in sizes ranging from ½" to 4" nominal pipe sizes. Molded fittings are available for pipe up to 2" IPS and fabricated fittings are available for larger sized pipe.

The high chemical resistant pipe will be distributed country-wide under the trade name AMPCOFLEX, and the high impact pipe under the registered trade name, PEE VEE CEE.

David W. Hopkins Consultant for S. Morgan Smith

S. Morgan Smith Co., York, Pa. has announced that David W. Hopkins, executive vice president of R-S Products Corporation, Philadelphia, a subsidiary, has been appointed chief consultant for the Valve Division of S. Morgan Smith Company, with offices in Philadelphia and York.



Nestable Type Culvert Pipe

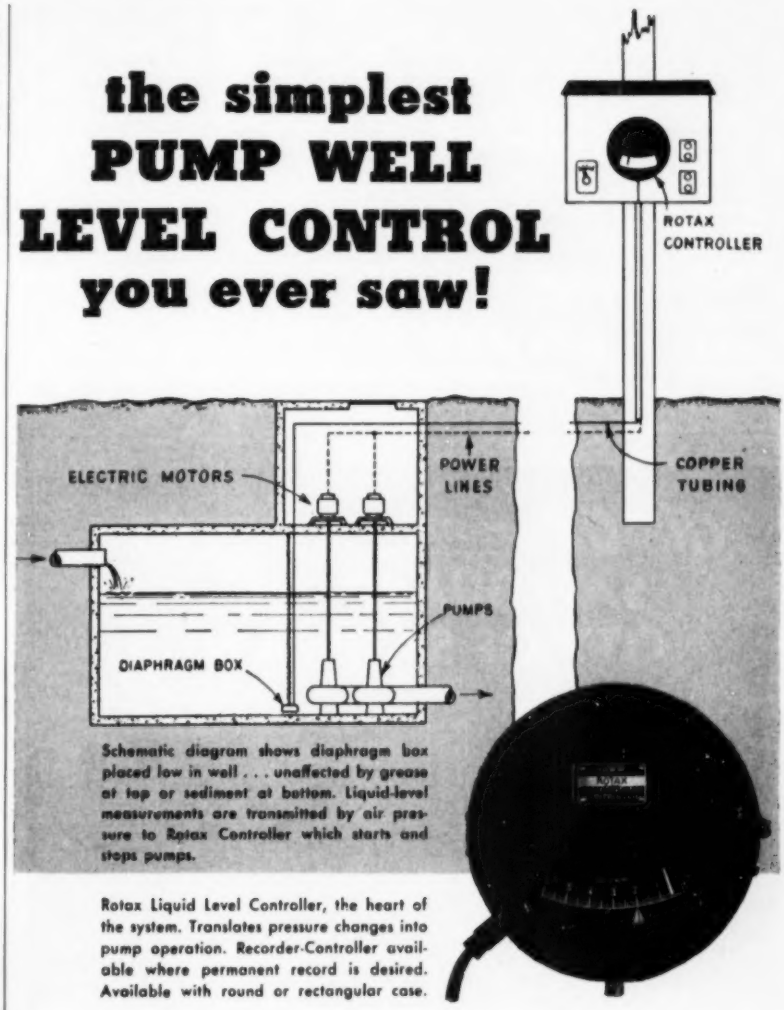
1106

Wheeling Corrugating Company, Wheeling, W.Va., has developed a nestable type culvert pipe, produced of corrugated galvanized sheets 25½" wide, and curved to form half circle sections.

The culvert pipe is made in short sections for ease in packing, shipping and application. Several sections are "nested" together with necessary nuts and bolts attached in a separate carton. This method of handling requires only a fraction of the space needed for standard circular culvert pipe.

The only tool necessary in laying the Wheeling pipe is a structural wrench. The longitudinal edges of

the simplest PUMP WELL LEVEL CONTROL you ever saw!



Schematic diagram shows diaphragm box placed low in well . . . unaffected by grease at top or sediment at bottom. Liquid-level measurements are transmitted by air pressure to Rotax Controller which starts and stops pumps.

Rotax Liquid Level Controller, the heart of the system. Translates pressure changes into pump operation. Recorder-Controller available where permanent record is desired. Available with round or rectangular case.

Easier to install . . . accurate for years without attention

For a new underground sewage pumping station, the town of Norwood, Mass., wanted automatic control that would perform dependably without attention, free from usual corrosion and maintenance problems. Foxboro Pump Well Level Control proved an effective solution . . . with the added advantages of greatly simplified installation and operation.

Foxboro Pump Well Level Control employs a simple cast iron or bronze diaphragm pressure box for measurement . . . instead of a float-type measuring system. No cables, levers, floats or pulleys to corrode or clog. The Foxboro Controller may be located up to 500 ft. from the well, with only a copper or stainless steel tube connection. All adjustments easily made at the instrument. Controller contacts not subject to corrosive atmosphere.

Get full details of this improved automatic Level Control for either water or sewage pump wells. Write for Application Engineering Data Sheet 831-9. **The Foxboro Company, 9811 Neponset Ave., Foxboro, Mass.**

FOXBORO Reg. U. S. Pat. Off. PUMP WELL LEVEL CONTROL

each section are formed with flanges in which slotted holes are provided for bolting sections together. Sheets are corrugated one-half inch deep with 2.66" spread from center to center of corrugations. Sections are 25½" in length and every two sections, when assembled make a 24" length of full circle pipe from center to center of lapped corrugations.

Hauer Elected V.P. of American Well Works

American Well Works, Aurora, Ill., has announced the election of Gerald E. Hauer as Vice President In Charge of Engineering.

Mr. Hauer who is well known in the Sewage, Industrial Waste and Water Treatment fields became a member of the American Well Works Engineering Staff in 1946, and was appointed Chief Engineer in 1948.

60 H.P. Close Coupled Pump Motor

1107

U.S. Electrical Motors, Inc., Los Angeles, Calif., has announced that close-coupled pump motors are now available as high as 60 H.P. Designed specifically for use with centrifugal pumps, this motor, type SCB, eliminates shaft alignment or pump mounting problems by supporting the pump on its NEMA style "C" registered mounting bracket. A step shaft, with special diameter, shoulder and tapped hole for mounting the impeller, has all ground diameters for precision assembly and sealing against leakage.

Grease lubricated ball bearings permit vertical, horizontal or any intermediate angle installation. Bearings are ample to carry the thrust of centrifugal pumps.

A solid, closed flange on the style "C" adapter bracket prevents entrance of the pumped liquid into the motor. To further effect this protection, a corrosion-resistant, bronze slinger is mounted on the take-off shaft for deflection of any packing leakage.

8 (of 14) Climax 12 cylinder, 510 H.P. Gasoline Engines driving Peerless 48" Propeller Type Vertical Storm Water Pumps, each having a capacity of 45,000 GPM against a 28-ft. Head.

A NEW seven million dollar sewage disposal system, designed by and constructed under the supervision of Hubbell, Roth & Clark, Inc., Detroit, has recently been placed in operation for Saginaw, Michigan. Included in the system are five storm water pumping stations, two of which are equipped with a total of fourteen Peerless 48" propeller type vertical pumps, each having a rated capacity of 100 c.f.s. (45,000 GPM) All 14 are driven by Climax 12 cylinder, 510 H.P. gasoline engines. Reliable and independent power is provided as utility power failure is frequently caused by electrical and atmospheric disturbances associated with floods.

climax

FOR COMPLETE INFORMATION, WRITE TO . . .

ENGINE and PUMP MFG. CO.

FACTORY AND GENERAL OFFICE: CLINTON, IOWA

REGIONAL OFFICES: CHICAGO, ILL., DALLAS, TEXAS

Electro Rust-Proofing Appoints R. J. Fitzgerald

Electro Rust-Proofing Corporation, Belleville, N. J. has announced the appointment of R. J. Fitzgerald as District Manager of its Middle Atlantic States Division, including southern Pennsylvania, Maryland, Delaware, Virginia and North Carolina.

Graduate engineer and former lieutenant in the U. S. Navy, Mr. Fitzgerald represents a nationwide service organization that for over 17 years has successfully engineered cathodic protection of steel structures ranging from elevated water tanks to deep well piping. His headquarters will be at 1113 17th St., N.W., Washington, D. C.

Self Loading Truck Crane

1108

Ray-Lind Manufacturing Co., Iron River, Michigan, has developed a line of very versatile loaders—adaptable for use on any truck. Available in a wide range of capacities, from ½- to 2-ton lifts, the unit converts a truck into a self-loading truck-crane that

speeds scores of materials handling jobs.

The crane unit mounts directly behind the cab and occupies only from 16" to 18" of space. There is no reduction in truck body or platform capacity and the entire load-carrying capacity of the bed is retained. Installation is simple as there is no need to cut or alter the truck body—it is simply moved back on the frame.

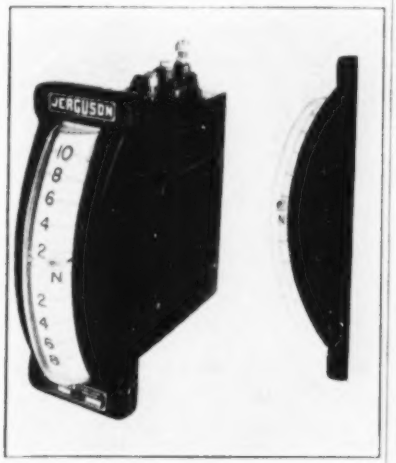
The loader is made in two models; one with an elevating mast, and one with a "fold-over" superstructure. Standard loaders will pick up loads from any radius up to 16 feet. On the "fold-over" models, the boom swings 170 deg., on the elevating mast models the swing is a full 360 deg.

Power for hoisting is supplied by the truck engine through a power take-off. The unique type of winch used employs standard automotive parts for simplicity of operation and service.

Cogshall Rejoins Pennsalt

Pennsylvania Salt Manufacturing Co., Philadelphia, Pa. has announced that after two years service as a Lieutenant Commander in the Navy, Mr. James H. Cogshall has rejoined the company as a sales engineer in the Corrosion Engineering Products Department.

Before Mr. Cogshall was called to the Navy in 1951, he served as a corrosion engineer at Pennsalt's Wyandotte, Mich., plant, where he supervised a study of the use of protective coatings in Pennsalt's plants.



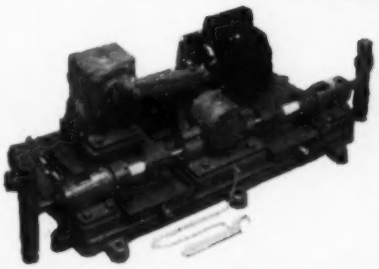
New Gage With Convex Face

1109

Jerguson Gage & Valve Co., Somerville, Mass., has developed a new con-

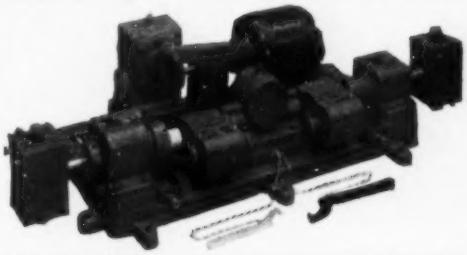
If you meter or proportion small volume flows...

THERE IS A HILLS-McCANNA "U" TYPE PUMP TO DO THE JOB



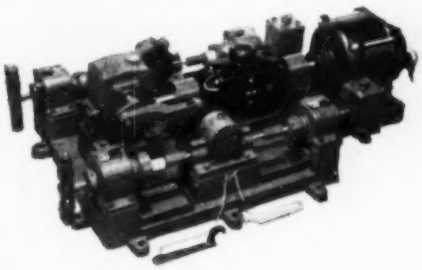
STANDARD 1, 2, 3 or 4 FEED UNITS

Standard "U" Pumps are available in maximum capacities from 0.10 to 24.0 gal. per hr. per feed. Operating pressures from 125 to 5000 psi.



JACKETED UNITS

For handling materials that require heat or refrigeration, "U" Pumps can be supplied with either or both jacketed liquid ends and check valves.



VARIABLE SPEED UNITS

"U" Pumps can be furnished with a variable speed drive which permits varying capacity remotely or automatically when combined with the proper auxiliary equipment.

Write for Catalog:

Catalog UP-52R gives full data on all sizes and types of Hills-McCanna "U" Type Pumps. Write for a copy, today. Hills-McCanna Co., 2357 W. Nelson St., Chicago 18, Ill.

HILLS-McCANNA

metering and proportioning pumps

Also Manufacturers of:
SAUNDERS TYPE DIAPHRAGM VALVES
FORCE FEED LUBRICATORS • MAGNESIUM ALLOY SAND CASTINGS

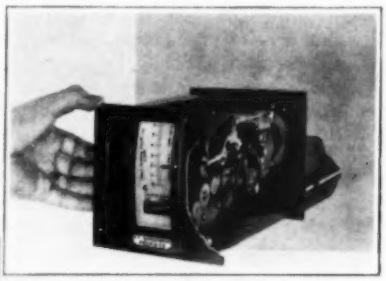
vex scale remote reading gage. The new convex scale permits full 180° visibility so it is possible to easily read the liquid level from anywhere in the control room from which the gage cover can be seen.

The new Convex Scale Jerguson Truscale is designed so that readings of the liquid level can be instantly taken from the front, or either side, without distortion. Scale markings are directly on the convex face. Indicator goes clear around the convex surface. It is possible to stand at one end of a control room and instantly check the whole line up of Truscale Gages.

MacKenna Named Tulsa Manager for Worthington

Worthington Corp., Harrison, N.J. announced that Mr. L. J. MacKenna has been appointed District Office Manager of the company's Tulsa Office.

MacKenna joined Worthington in July 1926, after graduating from Northeastern University with a degree of B.S.M.E. His first assignment was at the company's former Blake and Knowles Plant at East Cambridge, Mass. as an engineer. In 1927 he moved to the Harrison, New Jersey office as an application engineer, and in 1930 he transferred to the Detroit District Office as sales engineer. After two and a half years at Detroit, MacKenna moved to the New York Office as general line salesman.



Miniature Integrator-Indicator

1110

Fischer & Porter Company, Hatboro, Pa., has developed a miniature Integrator-Indicator incorporating a full size integrating mechanism and standard 5-digit counter. It is one of the company's series of Ratographic miniature instruments designed primarily for mounting in graphic panels. The unit, measuring 6 by 6 by 14⅝ in., indicates instantaneous rate and continuously integrates the measured variable.

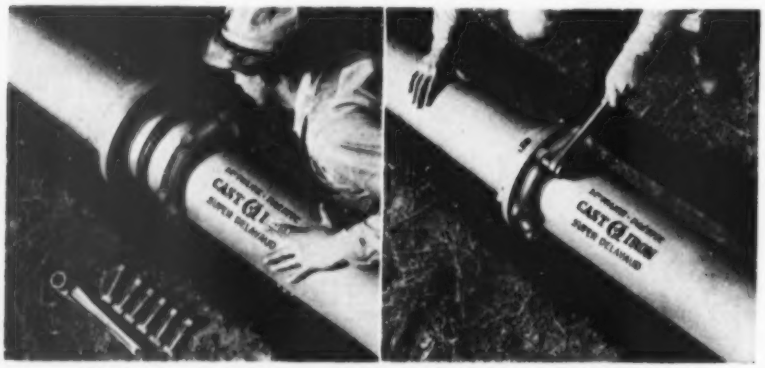
The high speed integrating unit senses and totals flow rate of the measured liquid or gas every 2.5 seconds—24 times per minute. This rapid counting rate allows varying flows to be totalized to accuracies within 1 per cent of full scale. Furthermore, it makes the totalizer responsive enough to take full advantage of the sensitivity of flow rate meters. Even slight variations of flow caught by the primary are picked up by the totalizer. The totalizing mechanism is oil-immersed for permanent cleanliness, lubrication, and freedom from wear and corrosion.

Instantaneous flow rate is indicated on a vertical strip by a pointer attached to the integrator calibration cam. The pointer is positioned along with the cam by a pneumatic receiver which operates at signal pressures of from 3 to 15 psig.

Lundy Appointed Ass't. Sales Manager for Peerless Pump

Peerless Pump Division, Food Machinery and Chemical Corporation, Los Angeles, Calif. has announced the appointment of Everett W. Lundy, as Assistant Sales Manager. Lundy, previously Pacific district manager for the pump firm, will be succeeded by Robert H. Hull, presently Peerless'

(Continued on page 99A)



EASY TO LAY

WITH UNTRAINED LABOR

SAVES TIME
REDUCES COSTS

McWane-Pacific Boltite mechanical joint pipe and fittings lay faster and reduce pipe line construction costs because the joints can be made by untrained workmen using only a ratchet wrench. Boltite is a better joint for either water or gas. Bottle-tight, leak-proof, yet flexible to allow settlement, or expansion and contraction of the pipe line.

All joint parts, glands, gaskets and bolts are interchangeable with pipe, fittings, valves and hydrants made by other manufacturers. For complete information, wire or write McWANE CAST IRON PIPE COMPANY, Birmingham, Alabama, or PACIFIC STATES CAST IRON PIPE COMPANY, Provo, Utah. (Sales offices in principal cities.)

McWANE PACIFIC PIPE Lasts for Centuries

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Enter key number in box.

Please PRINT your name and title, company or department name, and your address

NOTE—

These cards are to be used only for items described in THIS ISSUE

WATER & SEWAGE WORKS

Will see that you receive information desired.

(*Continued from page* 98A)

Central district manager at Indianapolis. Hull, in turn, will be succeeded by Waldo T. Harman, Peerless' Chicago branch office manager.

Lundy attended the University of California at Berkeley, class of 1925. Since graduation he has been identified in sales work with various manufacturers of engineered products, associating himself with the Peerless Pump organization in 1940. Successive promotion from sales engineer to branch office manager at Phoenix to Pacific district sales manager is now climaxed with his appointment to the newly created position of assistant divisional sales manager.

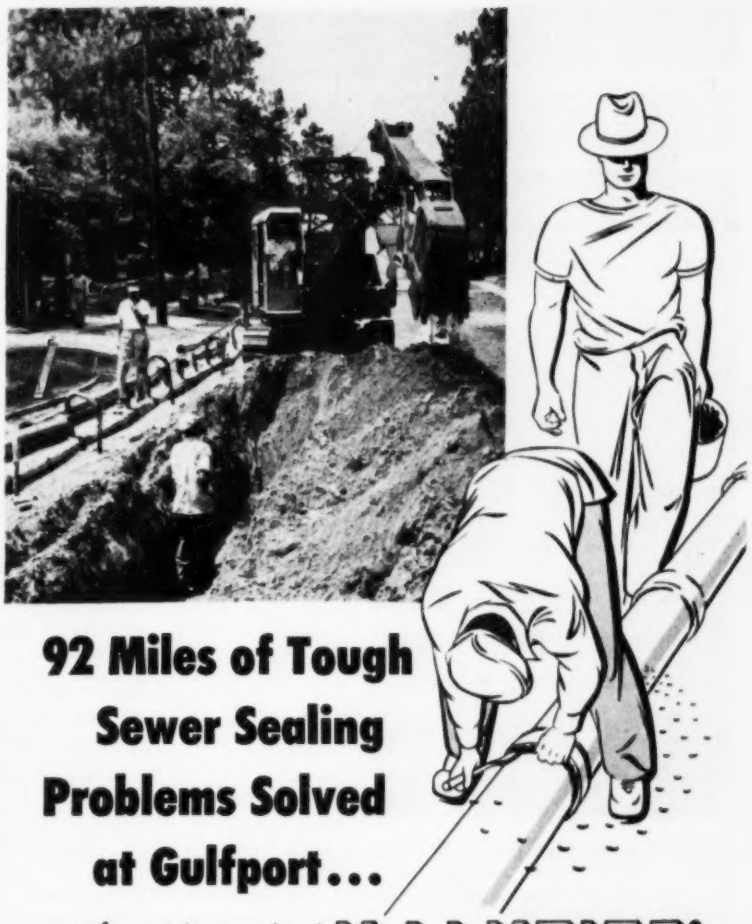
Adjustable Framing System Supports Tunnel Piping

Unistrut Products Co., Chicago, Ill., has announced that the new Joint Sewage Treatment Plant serving the twin Michigan cities of Benton Harbor and St. Joseph features a unique pipe support framing system which claims many advantages over conventional methods.

On this job, thousands of feet of piping and conduit were racked with Unistrut channel in some 700 feet of tunnel. In one area alone over 20 tons of overhead piping was supported by Unistrut concrete inserts and pipe hangers. The job was engineered and erected by The Silvis Company, Sheboygan, Wis.

The system, known as Unistrut, consists of steel channel members, concrete inserts, pipe rollers, brackets, clamps and fittings which are bolted together to form a framework of mechanical supports.

Completely adjustable, to assure exact pitch and permit changes and additions at any time, the system eliminates much engineering detailing and all special erection equipment. Assembly is accomplished with just a saw



92 Miles of Tough Sewer Sealing Problems Solved at Gulfport...

with cold applied **KALKTITE®**

Gulfport, Miss., recently tackled its first complete sanitary sewer system . . . 485,000 ft. of 6" to 36" pipe laid under very difficult construction conditions . . . normal ground water level averaging approximately 18" below ground and subsoil consisting of fine white sand. Every lineal foot of trench had to be de-watered by an elaborate well point system operating continuously.

Presstite's KALKTITE compound was selected to seal the sewer joints under these tough conditions because it is . . .

- ***mixed and applied cold*** on the job.
- ***so highly adhesive*** to the pipe that it makes tight joints even under adverse pipe laying conditions.
- ***tough and flexible,*** allowing for normal sewer line settlement and some alignment deflection during backfilling.
- ***unaffected by acids,*** gases and alkalies of sanitary sewers and contains an ingredient poisonous to vegetation and tree roots.
- ***economical to use,*** allowing installation of more joints per man, per hour, per day.

The engineers' check for water infiltration shows the bulk of the lines have such negligible infiltration that no infiltration tests were necessary.

PRESSTITE SEALING COMPOUNDS

Write today for more detailed information on the superior qualities of cold applied KALKTITE sewer joint sealing compound.

PRESSTITE ENGINEERING COMPANY

3780 Chouteau Ave. St. Louis 10, Missouri

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

SAVE HOURS,

CUT COSTS ON YOUR

PIPING JOBS

PUSH PIPE UNDER STREETS, TRACKS, walks, floors and other obstacles with a GREENLEE Hydraulic Pipe Pusher. One-man-operated, portable, simple to operate. No tearing up of pavement . . . eliminates extensive ditching, tunneling, back-filling, tamping, repaving. Cuts job time to a fraction. GREENLEE Hydraulic Pipe Pusher often pays for itself on first job. Two sizes—model shown above for pushing ¾′ to 4″ pipe. Larger unit, below, for pipe over 4″, concrete sewer pipe and large drainage ducts. Power pump also available for extra ease and speed of operation.

GREENLEE

Write today for descriptive literature. Greenlee Tool Co., 2251 Columbia Avenue, Rockford, Illinois, U.S.A.

and wrench — no drilling or welding required.

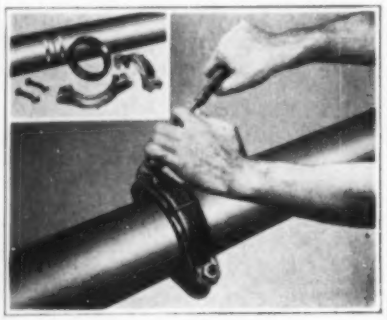
Neptune Meter Sells Rensselaer Valve

The Neptune Meter Co., New York, N.Y., has announced the sale of its subsidiary, the Rensselaer Valve Co., of Troy, N.Y., to an investment group headed by David Berdon and Jay Levine, 511 Fifth Ave.

John H. Ballantine, chairman of Neptune, said the sale is part of a program to concentrate its entire efforts in the water works field on the production and sale of meters and meter parts. Neptune also makes meters for measuring liquids in the petroleum, chemical, food and other industries.

Rensselaer operations in the production and sales of water works valves and hydrants will remain unchanged, according to spokesmen for the investment group which acquired the Troy firm.

Management personnel and policies of Rensselaer also will continue unchanged, it was announced. Lyman C. Thumfors of Troy, who was vice president and general manager of Rensselaer when it was affiliated with Neptune has been elected president of the valve and hydrant firm.



New Low Cost Coupling For Grooved Pipe

1112

Gustin-Bacon Manufacturing Company, Kansas City, Missouri, has developed the "Gruvajoint," a new lightweight coupling for grooved pipe systems.

Gruvajoints are specifically designed to save time, weight, freight and space in coupling grooved pipe systems where pressures do not exceed 500 pounds per square inch. The original cost is approximately 15 per cent less than conventional grooved pipe couplings; weight, about 40 per cent less.

REPLACE troublesome VALVES With . . .

EDDY MECHANICAL JOINT GATE VALVES

Old and troublesome valves . . . or too few valves in a distribution system . . . can be responsible for dangerous and costly slow-down or shut-down of water supply for every day use or, more serious, when badly needed in event of an emergency. Now is the time to make replacements and to install new valves where conditions show the need for so doing. The Eddy Valve, bronze mounted throughout, with mechanical joint connections (only a ratchet wrench needed) is best for easy installation . . . for easy operation . . . for long life trouble-free service.

Write today for prices and delivery date for valves needed to modernize your water distribution system.

EDDY VALVE COMPANY

A Subsidiary of James B. Clow & Sons

WATERFORD, NEW YORK

The new couplings automatically absorb expansion and contraction, shock, ground motion and vibration. They remain leakproof under end pulls up to 7500 pounds; permit layout misalignment up to 3°; withstand temperatures between 200° F., and minus 65° F. Gruvajoints can be applied or removed in approximately one minute. They can be used again and again. Gruvajoints are suitable for permanent or temporary lines.

Green rust inhibitor protects the entire surface of these malleable iron couplings. The sealing gasket is of resilient synthetic rubber designed to resist the deteriorating effects of oil and chemicals. Gruvajoints are available in 2", 3" and 4" sizes.

Simplex Appoints New Service Engineer

Simplex Valve & Meter Company, Philadelphia, Pa., is initiating the establishment of service engineering personnel in key areas throughout the country. This program was recently started in order to localize service calls and improve service conditions.

In line with this policy, Ralph N. Cramer, service engineer, has established his headquarters at 412 Ashburton Road, Columbus, Ohio. From this central point, he will handle all service engineering requirements in the Ohio, Lower Michigan, Western Pennsylvania, Western New York, Kentucky and Tennessee areas.

Electronic Flow Meters

1113

The Hays Corporation, Michigan City, Ind., has developed a new flow meter of the electronic type which makes use of mercury-less bellows type transmitters. This meter is available in several different models for indicating, recording and with a continuous type mechanical integrator or combinations thereof for measurement of the flow of fluids.

The differential pressure transmitters used with the meter are of the metallic bellows, rupture-proof type for differentials of from 20" water to 750" water with a standard static operating pressure of 1500 psig. Higher pressure ratings can be supplied if required. The meter is also available for the measurement of liquid level in an enclosed vessel. The transmitter for this application differs from the others in that it is of the buoyant float operated type with torque tube assembly. The transmission system employed between the transmitter and recorder makes use of differential

STEVENS

TYPE B-FT RECORDER PROVIDES PERMANENT DATA ON SEWAGE FLOW

At this modern sewage treatment plant in Dallas, Oregon, the STEVENS Type B-FT Recorder provides a permanent graphic record of flow in million gallons per day (range 0-6 MGD) and totalizes the volume in gallons. The STEVENS Recorder is mounted over a stilling well connected to a 9" throat width Parshall flume.

record flow accurately... automatically

There is good reason why modern municipal sewage and industrial waste measuring installations use the STEVENS Type B Recorder. It may be wall, pedestal or panel mounted, is easily operated and will give a lifetime of accurate, trouble-free service. This Recorder uses a circular chart which makes one revolution per day or per seven days, as specified, while the pen swings in an arc around an external center—the combined movements thereby producing a graph of the rate of flow (or head) against time. Volume is indicated on a counter-type totalizer. Accuracy of the registration is limited only by the accuracy of the rating to which the totalizer is set. Flow or head (or both) may be indicated on a scale clearly visible through a large glass port.

RECORDS FLOW
RECORDS HEAD
TOTALIZES FLOW
Direct Float Operated or Remotely Controlled

To find out more about the STEVENS Type B Recorder, and how it can simplify the task of compiling accurate flow records, write for FREE Bulletin 25.

SEND FOR NEW STEVENS DATA BOOK

Puts interpretive data at your finger tips. 144 pages of technical data... information on float wells and recorder installations... a wealth of hydraulic tables and conversion tables.

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Foremost in Precision Hydraulic Instruments Since 1907

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NO OTHER PIPE JOINT Can Equal BOND-O

- *In First Cost*
- *In Uniformity*
- *In Performance*

A careful survey of pipe joint costs will surprise you as to how much you can save with BOND-O. The low installation cost as well as a perfect performance record proves that nothing else equals BOND-O.

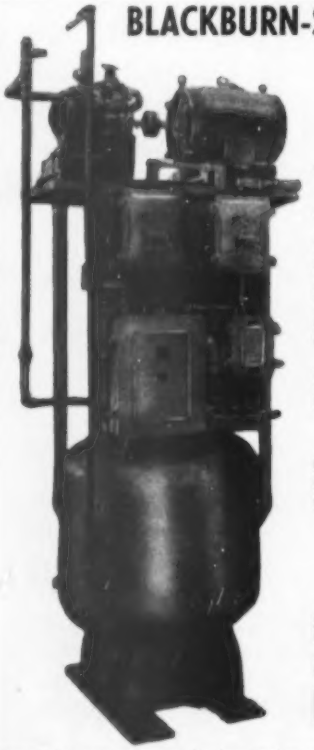
This self-caulking compound is accurately formulated and is used for jointing cast iron bell and spigot pipe.

Machine-blended by a unique process, BOND-O makes joints that are uniform and trouble-free. No BOND-O failure has ever been reported.

Write for literature today.

NORTHROP & COMPANY, INC.
SPRING VALLEY, N. Y.

BLACKBURN-SMITH SEWAGE EJECTORS



Compact ejector system having motor compressor assembly and all controls in one "packaged" unit.

RATED TO HANDLE

12,000 GPM OF SEWAGE

WERE FURNISHED IN 1952 ALONE

The above figure represents the rated amount of sewage handled by Blackburn-Smith ejectors in one year alone, attesting to the wide usage and desirability of a good, dependable, rugged pneumatic sewage ejection system.

30 to 500 GPM in both single and twin units against high discharge heads.

Exclusive Modern Features

Over 50 years service has proved the worth of Blackburn-Smith Ejectors. Yet our today's product is full of exclusive modern features such as:

1. Float and electrical float switch controls.
2. Float and pneumatically controlled snap action valve.
3. Electrode controls.

Any one of the above, with or without Air Receivers. Get Catalog S.

REPRESENTATIVES WANTED. ADDRESS:

Blackburn-Smith Mfg. Co. Inc.

98 River St., Hoboken, N. J.
Phones: HOboken 3-4425
REctor 2-9360

transformers and a null balance AC system independent of line voltage variations. An electronic amplifier in the circuit of the meter assures maximum sensitivity and a great speed of response. The six counter integrator is continuous in operation and simple in mechanical construction.

Gilbert, of Chain Belt Retires

Chain Belt Company, Milwaukee, Wis., has announced that Mr. George D. Gilbert, Secretary and a Director of the Company, has resigned as an officer and division manager. The resignation follows 35 years of continuous service with the organization, and is in order that he may devote more time to his personal affairs.

Gilbert was elected a Director of Chain Belt Company in 1939, when the Baldwin-Duckworth Chain Corporation was acquired by Chain Belt. In 1942 he was elected Secretary of the company and made General Manager of the Baldwin-Duckworth Division, positions he has held since that time.

Fibered Pipe Insulation

1114

Owens-Corning Fiberglas Corporation, Toledo, Ohio, is now manufacturing a finer fibered pre-formed pipe insulation which includes all the advantages of the old product plus more resistance to abuse, easier handling and improved thermal efficiency. There is no increase in price.

For use at temperatures from subzero to 450 degrees Fahrenheit, the new pipe insulation, like the old product which it replaces, is available with canvas coverings, or vapor seal jackets for cold lines and with a waterproof roofing felt jacket for outdoor use.

The thermal conductivity of the fine fibered insulation has been improved about 5 per cent over the excellent thermal efficiency of the old product.

Fine fibered pipe insulation is durable, fire-safe, non-corrosive, moisture resistant, easily fabricated, resilient, and provides no sustenance for insects, mold growth or vermin.

Stainless Steel Coating Type of Finish Now Developed in 10 Colors

1115

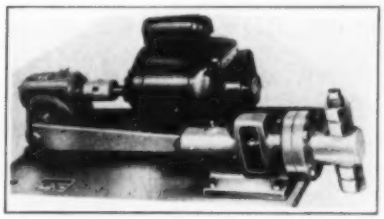
Steelcote Mfg. Co., St. Louis, Mo., has developed a new line of products now available under the trade name STEELAST. The formula for "Steelast" products is basically the

same as that of Stainless Steel Coating in that both use a vinyl plastic vehicle, the primary difference being that a change of pigment makes possible the manufacture of all colors including: Black, White, Gray, Ivory, Green, Red, Orange and Yellow.

"Steelast" produces the toughest type film of any ever tested in Steelcote Laboratories, impervious to moisture, resistant to most chemicals, and is odorless and non-toxic when dry.

The uses in which "Steelast" offers advantages over ordinary coatings are protection and finishing of metal surfaces on original equipment, and maintenance of machinery, pipes, tanks, duct work and metal building materials, indoors and out. "Steelast" can be sprayed, brushed or dipped. It will withstand constant wet heat up to 180° Fahrenheit and constant dry heat up to 300° Fahrenheit. Dries to handle in 30-60 minutes after spraying; 2-3 hours for recoating. May be force dried in 10 minutes.

Can be applied to rusted or bare unrusted metal after surface has been treated, or over painted surfaces that show positive after pretest with primer.



High Pressure Proportioning Pumps

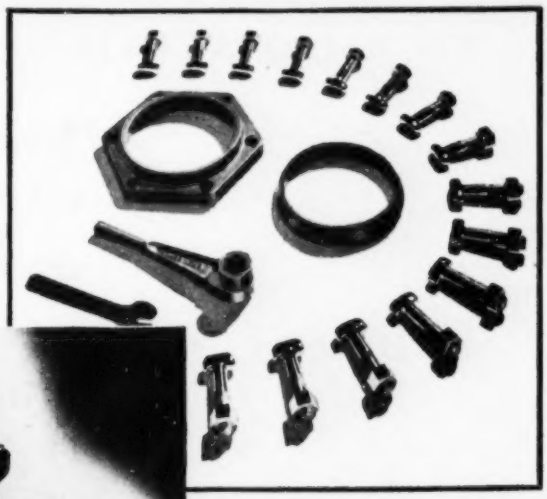
1116

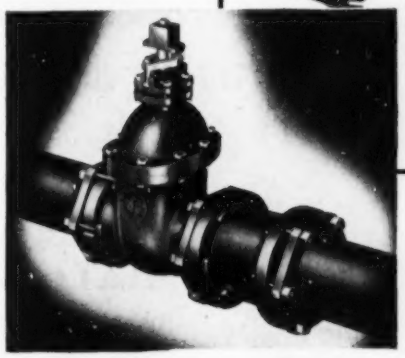
Walter H. Eagan Co., Inc., Philadelphia, Pa., has developed a new line of low cost proportioning pumps.

The standard models meter precise quantities of viscous materials, slurries, suspended solids and corrosive liquids in a range of from 0 to 100 gph at pressures to 1200 psi. Special units can be obtained with capacities to 300 gph at pressures to 20,000 psi.

Automatic controlling devices are available that adjust capacity while the pump is operating and all models can be made with special metals, oversized valves, water seals and motors to meet particular operating conditions. Dual suction and discharge spring loaded valves with check balls that seat positively assure the greatest degree of accuracy. In addition, the pumps are designed so that packing can be changed without breaking pipe connections.

ALL YOU NEED





IS: A RATCHET AND OPEN END WRENCH, THREE RUBBER GASKETS, THREE CAST IRON FOLLOWER RINGS AND A HAND FULL OF BOLTS AND NUTS TO INSTALL

the New SMITH CUT IN VALVE & SLEEVE

Gone are the days of—large costly excavations—melting furnaces and pouring pots—pouring and caulking lead joints—when the New All Mechanical Joint Smith Cut In Valve and Sleeve is used.

The Cut In Valve can be installed rapidly, in fair or stormy weather on Cast Iron A.W.W.A. and Federal specification water mains, by unskilled labor, using only two wrenches.

Moulded rubber gaskets fit into machined "Stuffing Box" type joints, guaranteeing a permanent leak-proof seal.

Smith Cut In Valves are manufactured in compliance with the A.W.W.A. Gate Valve specification, and all parts are interchangeable with like parts of Smith A.W.W.A. Gate Valves.

Write for Bulletin No. MJ2

37

SIDE HYDRANTS SINCE 1880

THE A.P. SMITH MFG. CO.

EAST ORANGE, NEW JERSEY

HYDRO-TITE

DEPENDABLE JOINTING COMPOUND

Seals Bell and Spigot Water Mains

Economical—Effective

Over 35 Years Of Dependable Performance

HYDRAULIC DEVELOPMENT CORP.

MAIN SALES OFFICE 50 CHURCH ST., N.Y.C.

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"Every individual connected with water purification or sewage works should subscribe to this publication. I have introduced it to a host of friends in this field"

Testimonials such as this from subscribers to WATER & SEWAGE WORKS really tell the story. The man who reads and uses the magazine as an aid in his work knows how much it will benefit other workers in the field.

The great REFERENCE & DATA issue alone is worth more than the yearly subscription rate. In it you will find formulae, charts and illustrations covering information not obtainable in any other one source.

Supply of 1953 REFERENCE & DATA number is limited. If you are not a subscriber send your order today!

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- *If you are interested in the water field only you get all the authoritative data on this subject.*
- *If you are interested in sewage problems only you are kept fully informed and given much help in this field.*
- *If you are interested in both subjects you get all the information in this one monthly magazine.*

Koppers Adds New Building at Verona

Koppers Company, Inc., Pittsburgh, Pa., has announced that it has purchased approximately two acres of land directly east of its present Research Center at Verona, Pa., and will start at once to erect additional research facilities, primarily for its Tar Products Division.

Fred C. Foy, Vice President and General Manager, Tar Products Division, said that a one-story building, approximately 80 by 160 feet will be completed by late spring of next year to house service and testing laboratories of the Tar Products Division. Approximately 40 employees of the Division will then have offices there, moving from present rented quarters in Pittsburgh.

Grease Interceptor With Automatic Grease "Draw-Off"

1117

Josam Manufacturing Company, Michigan City, Ind., has developed a new Series "JH" grease interceptor.

The main feature of this new Series "JH" Grease Interceptor is that it permits the intercepted grease to be drawn off automatically at the turn of a valve.

Josam has applied a new principle to this Series "JH" Grease Interceptor called "low pressure" or partial vacuum. The standard principle of gravity separates grease from water because grease is lighter and floats to the top. In the "low pressure" chamber, the grease continues to collect where it can be drawn off at any time . . . without removing the cover.

The grease collecting chamber may be emptied at any time simply by turning handle of control valve to the "draw-off" position. This closes the waste line and automatically opens the grease discharge line, adjacent to which, is placed a container to catch the liquid grease flowing out of the collecting chamber.

When all the stored grease is drawn off, the valve is turned to "on" position which automatically puts the interceptor back in operation for grease interception.

The intercepted grease in the collecting or "low pressure" chamber in this new Josam Interceptor is relatively pure and can remain in the collecting chamber without bacterial or decomposable action since these processes, according to the manufacturer, do not take place in a "low pressure" area.

DEPENDABLE PERFORMANCE

AT LOWEST COST

FILER & STOWELL SLUICE GATES

are built to stand long trouble free service. Amply proportioned for all stresses of shipment, erection and operation. They may be obtained with manual, hydraulic cylinder or motor operating controls.

THE FILER & STOWELL COMPANY
MILWAUKEE 7, WISC.

BELL JOINT LEAK CLAMPS
GASKET SEALER COMPOUND
CHARCOAL CAST IRON BOLTS

Also Anchored Glands for mechanical joints to replace socket clamps.

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Inspection
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Elevated Tanks and Standpipes

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ROTO-TROL 940

CONTROLS that are dignified by a background of long experience and infallible operation. ROTO-TROL 940 controls pumps, valves, alarm circuits, etc., from one float. Starting and stopping positions, rising and falling, can be set as required. Each circuit is independent. Mercury switches with snap action are used. ROTO-TROL 940 can be easily set on the job.

Write for Bulletins

Water Level Controls Division

HEALY-RUFF Company

783 HAMPDEN AVE., ST. PAUL 4, MINN.

Proved Features—Improved Protection

- Fence fabric galvanized throughout
- Improved welded gates and locking devices
- Extra post and rail ties
- Heavy post caps and barb arms
- H-Section line posts, 15% heavier
- Engineered erection

*Trade Mrk. Reg. U. S. Pat. Off.

CONTINENTAL STEEL CORPORATION
Kokomo, Indiana

Please send FREE copy of "Planned Protection"—complete manual on property protection.

Name

Address

City State

CONTINENTAL STEEL CORPORATION

Electronic Controllers

1118

The Bristol Company, Waterbury, Conn., has announced a new line of Free-Vane Electronic Controllers. The new instruments are part of the Series 500 line, and are available as indicating or recording controllers for temperature, pressure, flow, liquid level, humidity and time program control. They use the standard Bristol measuring elements.

Based on a frequency modulation principle, the Free-Vane Controllers are offered for low-open, high-open, low-high, low-open-high or low-normal-high control, as well as proportional input control.

Various combinations of one or two recording pens or indicators with one or two control units in one case makes the new controllers adaptable to a wide range of control problems.

Literature & Catalogs

New Reservoir and Standpipe Bulletin

1119

Chicago Bridge and Iron Company, Chicago, Ill., has issued a new 24 page booklet on **"Horton Steel Reservoirs and Standpipes."** It contains illustrations of installations from 50,000-gals. to 10,000,000-gals. capacity with cone, umbrella or ellipsoidal roofs and ornamental structures with special architectural features. Also a table of standard capacities, information on foundations, the advantages of pickling and painting the plates used in building steel reservoirs and standpipes and data on the use of suction tanks for fire protection.

Telemeter Multiplexing System

1120

The Bristol Company, Waterbury, Conn., has just released a bulletin describing the company's new **Multiplexing Transmitting and Receiving System** for use with Metameter Telemeters. It describes the use of the new system for transmitting up to 15 readings (over a single circuit and distance) of pressure, vacuum, temperature, flow, water or liquid level, static and differential pressure, motion, voltage, current, or totalized load taken at separate locations or areas to Metameter receiving instruments.

M-SCOPE Pipe Finder

LIGHTWEIGHT MODEL

One Man Operation

Catalog No. 25G on Request

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New Hyde Park New York

TRANSITE FILTER BOTTOMS CUT YOUR FILTRATION COSTS

Check THESE FEATURES:

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- ✓ strong, stable support

• Made so gravel cannot clog or obstruct ports, these strong, durable transite filter bottoms are stable under all conditions. Easily assembled with only a screwdriver in 5 minutes.

OFFERS SUPERIOR FILTER PLANT PERFORMANCE AT LESS COST

Write for More Information

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Proportioneers Bulletin Catalog

1121

Proportioneers, Inc., Providence, R. I., has available a catalog of bulletins pertaining to **Constant Rate and Flow Responsive Chemical Proportioning.**

The catalog lists 40 different bulletins or reprints on this subject with short descriptive text about each one. A postage paid order card is included in the catalog.

Tank Insulation

1122

Pittsburgh Corning Corporation, Pittsburgh, Pa., has just published a new four-page folder, **"FOAMGLAS, the Long-Life, All-Temperature Insulation for Tanks and Other Equipment."**

The folder presents the physical properties of the unique cellular glass insulation and lists the sizes and shapes available and recommended thicknesses required for temperatures ranging from —50° to 800° F. Condensed suggested specifications and photographs of applications make the folder an ideal reference for engineering and maintenance personnel.

Factors in Selecting Chlorine Gas Feeders for Sewage Chlorination

1123

Builders-Providence Inc., Providence, R. I. has announced the availability of a technical information sheet, for use in the selection of **Chlorine Gas Feeders for Sewage Chlorination.** This sheet has been prepared as a guide for Engineers and others interested in the application of Chlorine for Sewage treatment and contains information on the purposes of Sewage Chlorination, types of Chlorination, points of application, modes of control, types of feed, types of feeders, location of equipment, etc.

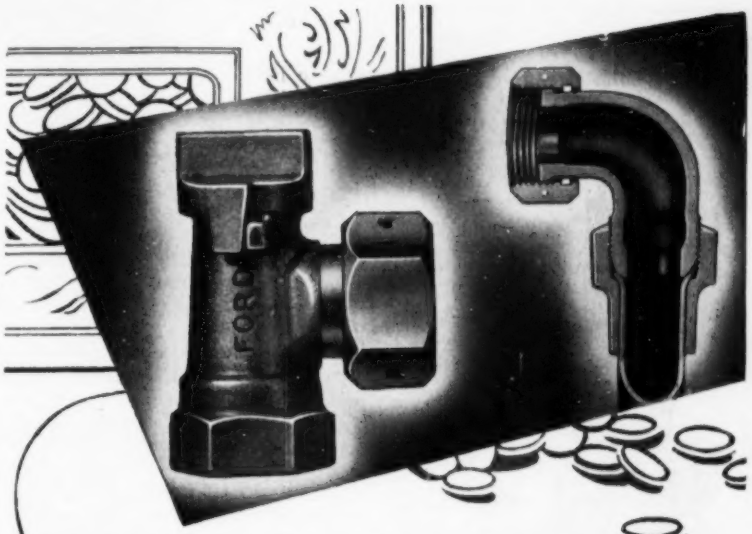
Link-Belt Products

1124

Link-Belt Company, Philadelphia, Pa., has published a **Directory of Link-Belt Products and Link-Belt Company.**

The directory, composed of 7 general sections, covers: Products; Industries; Research and Engineering; Manufacturing Plants; Offices and Personnel; Distributors; and Export Sales Representatives.

The products section is grouped as to chains, drives, transmission



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Never, until Ford's Ringstyle Valves and Couplings were invented, was it possible to set a meter in such close quarters or with so few fittings.

The secret lies in the Ringstyle construction—a threaded coupling nut is pushed over a machined flange from the face side and then a bronze ring is driven into a groove in the nut and behind the flange, making a strong shoulder. These ingenious fittings really hit the jackpot when it comes to saving time and labor costs.

For complete information, send for Ford Catalog No. 46.

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FOR BETTER WATER SERVICES

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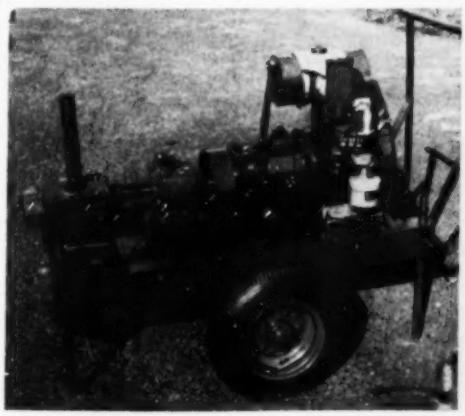
Wabash, Indiana



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CLINTON, CONN.

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

products, conveyors, auxiliary products and shovel-cranes, and also lists the various catalogs available. Under the Industries section, two pages are devoted to sewage and industrial waste.

Correcting Leakage in Reservoirs

1125

American Bitumuls & Asphalt Co., San Francisco, Calif., has issued a bulletin on how a leakage volume of 16,000 gals. per day was stopped at the Lake Chabot, (California) million-gallon reservoir.

Entitled **"LAYKOLD Weathercoat for Reservoirs,"** the bulletin provides detailed information, specifications, and photographs on the use of Weathercoat in constructing impervious membranes for water storage facilities.

According to the bulletin the product is a factory-prepared, homogeneous mixture of asphaltic emulsion combined with mineral fillers. It is applied cold by trowel or spray, and sets to an odorless, non-toxic, moisture-proof coating. It is particularly effective in reservoir membrane linings since it performs through a wide temperature range and successfully resists the effects of time and weather.

In describing methods of construction of the 30 million-gallon Seneca Reservoir, East Oakland, California, the bulletin points out that the cost of features producing watertightness was 16% of the normal total cost of the reservoir.

Miniature Indicator

1126

Fischer & Porter Co., Hatboro, Pa., has published a 12-page bulletin on the construction, installation, and design features of a remote miniature **Ratographic Indicator.**

The 3-color bulletin uses photographs to show construction of the bellows spring assembly, which is the heart of the instrument, as well as details of other components. The bulletin explains incorporation of the various types of warning devices in the instrument.

Also covered is the method for setting up a control transfer station both to monitor a process variable and to reset the controller regulating a diaphragm motor valve.

Space requirements for panel mounting are given as well as specifications for: range of operating air pressures, scale types, graphic color guides or alarms, accuracy, and alarm switches.

St. Louis Turbidimeter

For measuring turbidity of water. Consists of cast aluminum housing, adjustable lamp . . . two vertical wells for holding two Nessler tubes.

This apparatus comes ready to plug into 115 volt line, comes fully equipped for normal operation.

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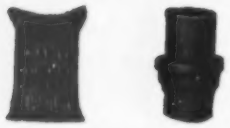


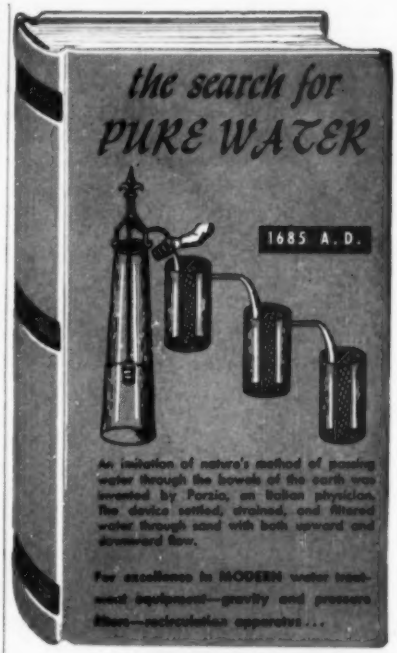
TABLE OF COMPARATIVE QUANTITIES

Nominal Inside dia. of pipe, in.	Depth of joint, Inches of Leadite	Approx. lbs. of Leadite per joint	Depth of joint, Inches of lead	Approx. lbs. of lead per joint
4	2.5	2.00	2.25	8.56
6	2.5	3.00	2.25	11.71
8	2.5	4.00	2.25	14.63
10	2.5	5.00	2.25	17.70
12	2.5	6.00	2.25	20.86
14	2.5	7.00	2.25	24.02
16	2.5	8.25	2.25	33.07
18	2.5	9.25	2.25	36.88
20	2.5	10.50	2.25	40.71
24	2.5	13.00	2.50	53.02
30	2.75	16.00	2.50	65.36
36	2.75	19.00	2.50	77.96
48	3.50	30.00	3.00	121.15
54	4.0	38.00	3.00	135.60
60	4.0	42.00	3.00	150.70

THE LEADITE COMPANY

Girard Trust Co. Bldg., Philadelphia 2, Pa.

No Caulking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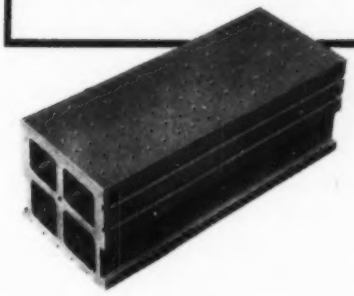
FILTER BOTTOMS



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With its many exclusive advantages, the Leopold Compound Duplex Filter Bottom provides the most practical and economical answer to your underdrain problems.

In this design, laterals and distributing blocks are combined in one permanent unit that insures uniform filtration over the entire filter bed and equal distribution of the wash water with minimum loss of head. The individual blocks—each about two square feet in area and weighing approximately 100 pounds—are made of highest quality de-aired fire clay, vitrified and salt glazed. They resist corrosion, are not subject to tuberculation, won't absorb any detrimental amount of water, and are impervious to acids and alkalis.

Adaptable to any rectangular filter unit, the efficient Leopold Filter Bottom needs only a shallow depth of small sized filter gravel to support the filtering medium. Further, the Leopold design does not require special supporting concrete members or the added concrete construction of a false bottom.

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- **DRY CHEMICAL FEEDERS**
- **FILTER OPERATING TABLES**
- **MIXING EQUIPMENT**

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Payloader Catalog

1127

The Frank G. Hough Co., Libertyville, Ill., has published a 16 page catalog on the Hough Model HR 4 Wheel drive **"PAYLOADER"** tractor-shovel. Profusely illustrated, it contains action views of this unusual 1 cu. yd. machine doing earth and material handling jobs for cities, counties, states, contractors, aggregate producers and industrial plants. Exclusive and important details are fully highlighted. Included also are pictures and detailed specifications of all seven sizes of Payloaders.

Fluoridizer Bulletin

1128

Omega Machine Co., Providence, R. I. has announced a new bulletin on their **Volumetric-Model 50 Feeder** for fluorides. This four page bulletin lists the advantages of the Omega Fluoridizer, describes the Feeder and discusses its operation, feed range and feeding mechanism. It points out further that this new Fluoridizer can be easily arranged to feed automatically in proportion to flow. Accessories described include dissolving chamber, scales, eductors, pumps and float valves.

The bulletin lists the following features of this Feeder: Extreme Accuracy, Rugged Construction, Compact Design, New Streamlined Housing, Low Filling Height and Dustless Loading.

Motor Starters

1129

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has just released a 12-page bulletin describing the features of **Allis-Chalmers Type H Starters** built to control squirrel-cage, synchronous, wound rotor and multi-speed motors in ratings from 2200 to 5000 volts.

The starters in ratings up to 3000 hp at 5000 volts are available with air or oil contactors depending upon application requirements. How these contactors are made and how they operate is explained in the bulletin.

The complete protection features of the starters—short circuit, overload, time relay undervoltage, and pullout protection—are covered in the bulletin, which also carries schematic wiring diagrams showing typical methods of control.

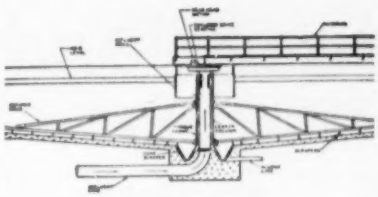
Controlled Volume Pumps

1130

Milton Roy Company, Philadelphia, Pa., has just issued a bulletin

(*Continued on page* 111A)

CENTER-DISCHARGE
CENTER-FEED
CLARIFIERS



One reason for the efficiency of Hardinge Clarifiers is the fact that the influent goes directly to a central stilling well and the underflow also is centrally removed. This promotes quick disposal of the heavier solids immediately upon entry—makes less work for the rotating sludge scrapers. The clear effluent overflows the tank periphery, where velocity is at a minimum. Bulletin 35-C-15.

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(Title 39, United States Code, Section 233)

Of Water & Sewage Works, published monthly at Mount Morris (Ogle County), Illinois, for October, 1952.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Edward Scranton Gillette, 185 North Wabash Ave., Chicago 1, Illinois; Editor, Linn H. Enslow, 155 East 44th St., New York 17, New York.

2. The owner is (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.): Scranton Publishing Company, 185 North Wabash Ave., Chicago 1, Illinois; E. S. Gillette, 185 North Wabash Ave., Chicago 1, Illinois; C. T. Gillette, 185 North Wabash Ave., Chicago 1, Illinois.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

E. SCRANTON GILLETTE
(Signature of publisher)

Sworn to and subscribed before me this 19th day of October, 1953.

[SEAL] R. L. SHANK, Notary Public.

(My commission expires Feb. 6, 1954).

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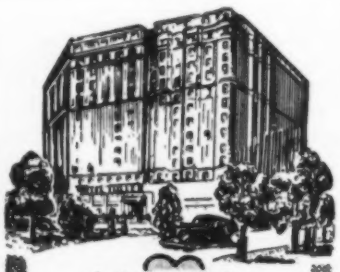

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(Continued from page 109A)

on **Milton Roy Motor Driven Controlled Volume Pumps.**

This 40-page bulletin contains valuable information covering design and construction of these pumps. Other technical data includes capacity-pressure selection tables; types of capacity adjustments; standard and special designs, as well as packaged systems. A two page chart describes typical applications in six major industries. Also included is a four-page materials selection chart in four colors, a valuable guide to chemists and engineers.

Spectrophotometry Explained In New Booklet

Beckman Instruments, Inc., South Pasadena, Calif., has just published a down-to-earth review of one of today's new sciences as found in the color-illustrated booklet, **"What Every Executive Should Know About Spectrophotometry."**

It presents the whole story of spectrophotometry—a technique for analyzing unknown substances by measuring the amount of light they absorb. Case studies show how this rapid electro-optical method has practically revolutionized control chemistry.

The 16-page booklet tells in readable "layman's" language just what a spectrophotometer is, how it works and what to look for in selecting an instrument for any of countless industrial and laboratory uses.

Full-color diagrams, curves and other illustrations serve to graphically demonstrate both theory and practical instrument design.

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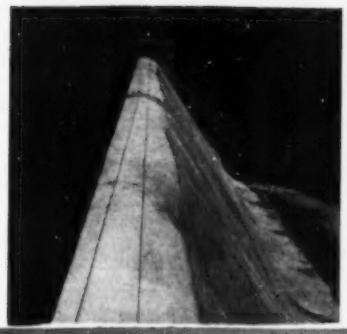

DAM REINTEGRATED WITH "GUNITE" BY CEMENT GUN CO.

Photograph above, left, shows Cement Gun Company crew preparing the spalled and disintegrated downstream side of a Virginia municipal hydro-electric dam for "Gunite." The "Gunite" was applied over reinforcing mesh to a depth of 2 inches greater than the original lines of the dam making the structure stronger and more durable than when it was originally built. To insure years of trouble-free service, "Gunite" was also applied on the upstream side to eliminate seepage through the dam. The finished job is shown in photograph below, left.

Completely pictured and described in our latest catalog, are many instances of dam construction and repair together with many other types of "Gunite" jobs we have done. A request, on your letterhead, for Catalog C2400 will bring your copy by return mail.

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MANUFACTURERS OF THE CEMENT GUN

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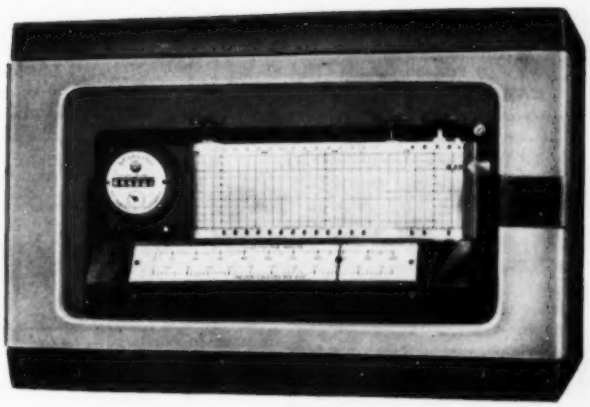

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